San Joaquin County and Delta Water Quality Coalition

Semi-Annual Monitoring Report

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List of Acronyms

BMP	Best Management Practice
BOD	Biological Oxygen Demand
BU	Beneficial Use
CDPR	California Department of Pesticide Regulation
CEDEN	California Environmental Data Exchange Network
COC	Chain of Custody
CURES	Coalition for Urban and Rural Environmental Stewardship
CVRWQCB	Central Valley Regional Water Quality Control Board
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DF	Dilution factor
DFG	California (Department of Fish and Game)
DHS	(California) Department of Health Services
DI	Deionized
DO	Dissolved Oxygen
DQO	Data Quality Objective
DWR	(California) Department of Water Resources
E	Environmental sample
EC	Specific Conductance
EC_{50}	Effective Concentration of 50% of the measured endpoint
EPA	Environmental Protection Agency
FB	Field Blank
FD	Field Duplicate
HDPE	High density polyethylene
ILRP	Irrigated Land and Regulatory Program
IPM	Integrated Pesticide Management
IRIS	Integrated Risk Information System
K_{oc}	Organic Carbon Partitioning Coefficient
LABQA	Laboratory Quality Assurance
LC_{50}	Lethal Concentration at 50% mortality
LCS	Laboratory Control Spike
MCL	Maximum Contaminant Level
MLJ-LLC	Michael L. Johnson, LLC
MPN	Most Probable Number
MRP	Monitoring and Reporting Program Order No. R5-2005-00833
MS	Matrix Spike
MUN	Municipal and Domestic Supply (beneficial use)
NA	Not Applicable
ND	Not Detected

NiCd	Nickel-cadmium
NM	Normal Monitoring
NONAG	The sample was provided by a project other than the Coalition to the laboratory and was included in the QC report from the laboratory to meet their QC requirements.
OP	Organophosphate
PCA	Pesticide Control Advisor
pH	Power of Hydrogen
PR	Percent Recovery
PTFE	Polytetraflouroethylene (Teflon™)
PUR	Pesticide Use Report
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RfD	Reference Dose
RL	Reporting Limit
RPD	Relative Percent Difference
RS	Resample
SAMR	Semi-Annual Monitoring Report
SG	Statistically significantly different from control; Greater than 80% threshold
SJCDWQC	San Joaquin County & Delta Water Quality Coalition
SL	Statistically significantly different from control; Less than 80% threshold
SOP	Standard operating procedure
SPE	Solid Phase Extraction
SWAMP	Surface Water Ambient Monitoring Program
TDS	Total Dissolved Solids
TIE	Toxicity Identification Evaluation
TKN	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon
TRS	Township, Range, Section
UC	University of California
USEPA	United States Environmental Protection Agency
VOA	Volatile Organic Analyte
WER	Watershed Evaluation Report
WQG	Water Quality Guidelines
WQTL	Water Quality Trigger Limit

List of Units

cfs	cubic feet per second
L	Liter
lbs	pounds
mg	milligram
NTU	Nephelometric Turbidity Units
ppm	parts per million
sec	second
TUa	Toxic Unit (acute)
TUc	Toxic Unit (chronic)
µg	microgram

List of Terms

Agricultural Commissioner – County Agriculture Commissioner

ArcGIS – Geographic Information Systems mapping software

Central Valley – California Central Valley

Coalition –San Joaquin County and Delta Water Quality Coalition

Coalition/SJCDWQC region – the region within the Central Valley that is monitored by the San Joaquin County and Delta Water Quality Coalition.

constituent of concern – any constituent that is the focus of monitoring

drainage –water that moves horizontally across the surface or vertically into the subsurface from land

landowners – one or more persons responsible for the management of the irrigated land

non ag waiver QA sample – sample results from another project other than the Coalition included to meet laboratory QC requirements.

Regional Board – Central Valley Regional Water Quality Control Board

site subwatershed – starting from the sampling site, all water bodies that drain, directly or indirectly, into the water body before the point where sampling occurs.

special study – a study conducted outside of normal monitoring activities that involves monitoring specific constituents in an effort to determine the mechanism responsible for the exceedances

subwatershed – the topographic perimeter of the catchment area of a stream tributary. (EPA terms of environment: (http://www.epa.gov/OCEPAterms/sterms.html)

Waiver – Central Valley Regional Water Quality Control Board Coalition Group Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands, Order No. R5-2006-0077, amending Order No. R5-2006-0053.

water body –standing or flowing water of any size that may or may not move into a larger body of water, including lakes, reservoirs, ponds, rivers, streams, tributaries, creeks, sloughs, canals, laterals and drainage ditches.

watershed – the land area that drains into a stream; the watershed for a major river may encompass a number of smaller watersheds that ultimately combine at a common point. (EPA terms of environment: http://www.epa.gov/OCEPAterms/wterms.html)

Executive Summary

The San Joaquin County and Delta Water Quality Coalition (SJCDWQC or Coalition) region includes parts of San Joaquin, Contra Costa, Alameda and Calaveras counties and comprises approximately 1,057,350 acres of which 548,362 (52%) are considered irrigated agriculture. There are three major San Joaquin River tributaries in the Coalition area: the Stanislaus River, Calaveras River, and Mokelumne River. Intermediate sized water bodies in the Coalition area are tributaries to the San Joaquin River, the Sacramento River, or the Sacramento-San Joaquin Delta. These water bodies are characterized as intermediate based on their drainage area and flow, and include Littlejohns Creek, Duck Creek, Lone Tree Creek, Bear Creek, French Camp Slough, Dry Creek, Marsh Creek, Middle River, Mormon Slough, Mosher Creek, Old River and Pixley Slough. Smaller water bodies found in the Coalition area are primarily canals and ditches that convey water to one of the larger rivers or intermediate creeks/sloughs, or are used to drain Delta islands. Irrigated agriculture is the predominant land use in the Coalition area, although urban areas in the region are continually growing. Other significant non-irrigated land uses include some acreage in feedlots and impoundments.

Water quality monitoring was conducted by the SJCDWQC in January during the 2008 storm season. Ambient water was sampled at 15 monitoring sites during January during the first large rain event after dormant spray. The rainfall trigger was not met for a second storm event. There was no measurable precipitation in March, making it the driest March on record. As a result, irrigation was initiated in late March to early April and irrigation season sampling was also initiated. If the Coalition had foreseen that a second event would not reach the rainfall trigger, it would have contacted the Regional Board and modified the trigger to collect a second storm. Sediment was collected for analysis from all sites during the month of March.

The primary objective of the storm season monitoring program was to characterize discharge from agriculture during the months when no irrigation was taking place. Field data were recorded during each sampling event, and ambient water samples were analyzed for pesticides, indicator bacteria, metals, inorganic and organic parameters, as well as toxicity to three test species; *Ceriodaphnia dubia, Pimephales promelas*, and *Selenastrum capricornutum*. During sediment sampling events, field parameters were measured and sediment samples were collected for an analysis of toxicity to *Hyalella azteca*. All water and sediment sample analyses were conducted according to specifications in Table 1 of the Monitoring and Reporting Program Order No. R5-2005-0833 for Coalition Groups under Resolution No. R5-2003-0105 Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands (MRP). Follow-up sampling to test for persistence of toxicity occurred within 48 hours from the time the laboratory reported toxicity.

The winter of 2008 was very dry compared to 2007 which was in turn, drier than 2006. Only one storm was monitored in 2008, which was the only major runoff event after the dormant spray season. Compared to the first storm of 2007, there were more exceedances in 2008. The circumstances surrounding the first storm in 2008 were unusual. The storm occurred over a three-day holiday weekend and was not predicted. The fast moving storm system virtually materialized over Northern California within a 48 hour period bringing substantial amounts of rainfall to the SJCDWQC region. Many growers were finishing dormant sprays or applications of herbicides for weed control and were caught unaware by the storm. As a result, many applications were made immediately prior to the unpredicted storm event leading to conditions that maximized runoff.

During the 2008 storm season, 14 organic pesticide exceedances of water quality triggers occurred, 3 of which involved chlorpyrifos. Other pesticides that exceeded water quality triggers in water samples included DDE (1), DDT (1), diazinon (3), diuron (4), and simazine (2). Water column toxicity was experienced in samples nine times; five of the samples were toxic to *Selenastrum capricornutum*, three to *Ceriodaphnia dubia*, and a single sample was toxic to *Pimephales*. Five sediment samples were toxic to *Hyalella azteca*. The toxicity to *Pimephales* was attributed to a known discharge of ammonia in lagoon water from a dairy. TIEs were performed on two samples toxic to *Ceriodaphnia* and four samples toxic to *Selenastrum*. TIEs could not be performed on one sample toxic to *Ceriodaphnia* and the sample toxic to *Pimephales* because of an extremely low concentration of DO or an elevated concentration of ammonia, respectively. It was not possible to bring these constituents into acceptable limits in able to determine if other constituents, i.e. metals or pesticides, were also causing toxicity. There were nine exceedances of the DO water quality trigger (7.0 mg/L), one exceedance of pH (showing high/basic pH levels), eighteen exceedances of the specific conductance (EC) water quality trigger, eight exceedances of the TDS water quality trigger, and 13 exceedances of the color water quality trigger. There were six exceedances of the *E. coli* water quality trigger and 10 exceedances of metals involving copper, arsenic, cadmium, lead, and boron. The increase in cadmium exceedances is due to a reduction of the concentration of the WQTL. Cadmium is a common detection in the region, including islands within the Delta, but the source of the cadmium is unknown. Peat soils, industrial emissions (i.e. burning of fossil fuels) and agriculture (i.e. phosphate base fertilizers) potentially contribute cadmium to aquatic systems. Sources are distinguishable using stable isotopes but the cost of the analyses is substantial and the Coalition does not anticipate using this technique to identify the source(s).

Outreach and education activities continue to be a central component of the Coalition monitoring program. Monitoring results were presented to growers at Coalition meetings held throughout the region to provide subwatershed trends and water quality problems, as well as management practices (BMPs) that have been proven to eliminate these problems. A Coalition website contains information for Coalition members or growers including a general description of the Coalition's mission and member information, recommended BMPs, a schedule of Coalition meetings and presentations, Coalition news and newsletters, maps of sample sites and site subwatersheds, and numerous links to other sources of relevant information (http://sjdeltawatershed.org/). In addition, the Coalition has developed a relational database to identify parcels/owners/crops and allow more rapid communication with individuals potentially responsible for exceedances.

The Coalition is creating a strategy to document and evaluate current management practices within the Coalition area and will first focus on priority subwatersheds. These include Duck Creek @ Hwy 4, Grant Line Canal @ Calpack Rd, Lone Tree Creek @ Jack Tone Rd and Unnamed Drain to Lone Tree Creek @ Jack Tone Rd. The Coalition will be holding a meeting in July 2008 where members who are associated with exceedances in the Lone Tree Creek and Unnamed Drain subwatersheds (based on PUR data) will be invited to attend. During this meeting, Coalition representatives will focus on talking with attendees and recording information about current management practices being implemented. Although the Coalition conducted BMP surveys in 2007, the Coalition plans to supplement that information with more detailed information obtained from individual grower contacts starting with priority subwatersheds.

The Coalition received a Proposition 50 grant which has been used to target site subwatersheds with persistent exceedances of pesticides and toxicity. The most effective strategy, due to limited funding, was for the Coalition to focus on two of the priority watersheds which have experienced a large number of exceedances over several years. During the winter, studies to determine the efficacy of several management practices were initiated. These studies will continue through the irrigation season and the next storm season. A second aspect of the Proposition 50 grant is to establish contacts with growers individually or in small groups. As a result of individual contacts in the Grant Line Canal subwatershed by Terry Prichard a UC Cooperative Extension specialist, a large grower/operator changed products to eliminate exceedances of chlorpyrifos. The same grower met with Coalition representatives to identify adjoining property owners in an attempt to contact other potential dischargers. In the Lone Tree Creek subwatershed Mr. Prichard held meetings with small groups of growers to discuss exceedances and the water management practices that could be employed to eliminate discharge of pesticides. The results of these efforts will not be known until next winter.

Over the 2008 storm season, the Coalition was able to meet its monitoring program objectives by determining the concentration and load of waste in discharges to surface waters, evaluating compliance with existing narrative and numeric water quality triggers to determine if implementation of additional management practices is necessary to improve and/or protect water quality and assessing the impact of storm water discharges from irrigated agriculture to surface water. The Coalition is currently developing a strategy for determining the degree of implementation of management practices to reduce discharge of specific wastes that impact water quality in receiving waters of the Coalition region, and developing strategies to reduce discharges of wastes that impact water quality. As the monitoring and reporting program moves into the next storm season, the Coalition recommends examining PUR reports from previous years to identify parcels that have been associated with repeated exceedances of pesticides, associating exceedances of pesticides with crops known to use the products to further refine the search for sources, if applicable, following the Management Plan monitoring plan by adding upstream sites to identify potential sources, and focusing outreach on small groups of growers identified as potential sources.

Introduction

This document is being submitted by the San Joaquin County and Delta Water Quality Coalition (SJCDWQC or Coalition) to the Central Valley Regional Water Quality Control Board (CVRWQCB or Regional Board) as required by the Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands Resolution No. R5-2003-0105 (Order), Monitoring and Reporting Program Order No. R5-2005-0833, amended by Monitoring and Reporting Program Order No. R5-2006-0053 and Monitoring and Reporting Program Order No. R5-2006-0077 (hereafter referred to as the Irrigated Land Regulatory Program or ILRP). The document reports on the Coalition monitoring program and covers activities associated with the 2008 storm season monitoring, reporting, outreach and education.

Data that are too substantial to include in the body of this report are located in separate appendices. Where appropriate, Semi-Annual Monitoring Report (SAMR) sections cite the appendices relevant to that section.

Description of Watershed

The Coalition region includes parts of San Joaquin, Contra Costa, Alameda and Calaveras counties and comprises approximately 1,057,350 acres of which 548,362 (52%) are considered irrigated agriculture (Figure 1). The County Agricultural Commissioner's offices, for San Joaquin, Contra Costa, Alameda and Calaveras Counties, note that there are 520,172 acres, 22,000 acres, 3,695 acres and 2,495 acres of irrigated farm lands in the Coalition region respectively in their counties (San Joaquin acreage is from the 2002 Agricultural Report). Contra Costa, Alameda and Calaveras County acreages are estimates because not all of the county area is within the Coalition area.

The northern border of the Coalition area corresponds to the county line between San Joaquin and Sacramento Counties. The eastern portion of the Coalition area was expanded in April of 2004 and now includes portions of Calaveras County that are the upper Calaveras River, Bear Creek, and Mokelumne River subwatersheds. These subwatersheds extend from San Joaquin County into Calaveras County. Agricultural land use in this part of the Coalition area is primarily orchards and vineyards and includes a very small amount of irrigated agriculture. The southern border of the Coalition area is the Stanislaus River with the exception of the Del Puerto and West Stanislaus Irrigation Districts at the southern edge of the Coalition area, which are not covered by the Coalition. As such, the Coalition boundary at the southwest corner of San Joaquin County is approximately that of the Delta Mendota Canal and California Aqueduct. The western boundary of the Coalition area has also been expanded and now lies along the western boundary of the CVRWQCB (Region 5) in Contra Costa County and Alameda County. There are several small subwatersheds in this portion of the Coalition region including the Kellogg Creek, Marsh Creek, Sand Creek, and Brushy Creek subwatersheds that drain the northern and eastern slopes of Mount Diablo. These water bodies flow east through urban areas on the western edge of the central Delta.

Within the Coalition area, the lower reaches of the San Joaquin River drain the eastern and western parts of the San Joaquin Valley. Drainage water is either exported to the San Francisco Bay through the Delta, or conveyed southward via the State Water Project and the Delta Mendota Canal. There are three major rivers in the Coalition area other than the San Joaquin River: Stanislaus River, Calaveras River, and Mokelumne River. These east side tributaries of the San Joaquin River drain a major portion of the Sierra Nevada Mountain range from east to west. The watershed of the Coalition area is the crest of the Sierra Nevada, and the drainage area is bounded by the San Joaquin River on the west, the Stanislaus River on the south, and the Mokelumne River on the north. Intermediate sized water bodies in the Coalition area (Littlejohns Creek, Duck Creek, Lone Tree Creek, Bear Creek, French Camp Slough, Dry Creek, Marsh Creek, Mormon Slough, Mosher Creek, and Pixley Slough) are tributaries to either one of the major rivers or empty into the San Joaquin Delta. Smaller water bodies found in the Coalition area are primarily canals and ditches that convey water to one of the larger rivers or intermediate creeks/sloughs, or are used to drain Delta islands. Figure 1 is a map of the agricultural lands in the Coalition region. The area shown in Calaveras County is the Upper Mokelumne and Upper Calaveras subwatersheds. Irrigated agriculture is located only in western Calaveras County and consequently the entire county is not shown on this map. The map provided in Figure 1 is in jpg format and consequently does not support a reasonable level of detail. More detailed maps are provided in the SJCDWQC Watershed Evaluation Report (WER) which was submitted March 16, 2007.

Figure 1. Agriculture lands in the SJCDWQC area.

The legend for land use is presented in Figure 2 below.

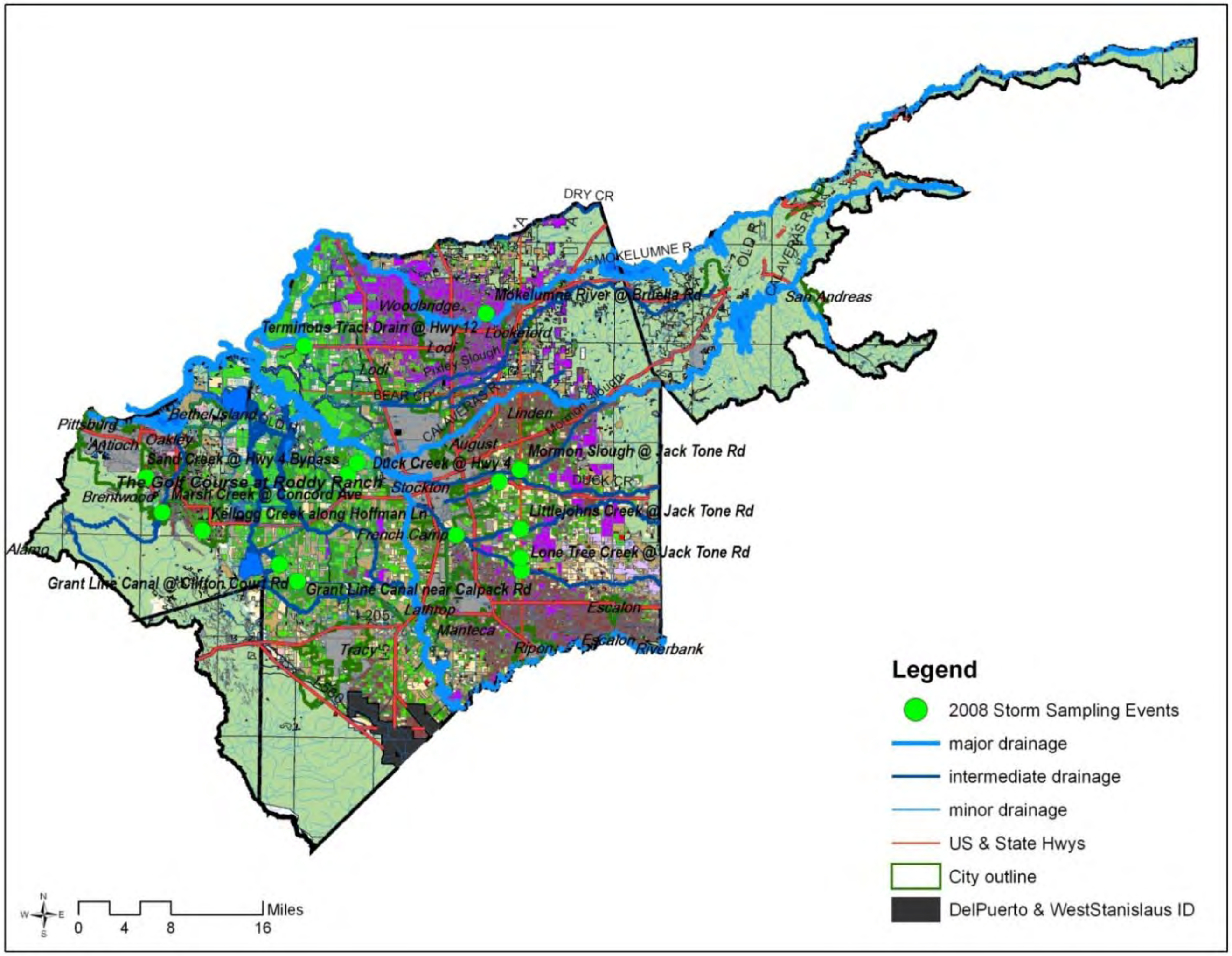


Figure 2. Legend for agriculture lands in the SJCDWQC area.

Land Use

Irrigated agriculture is the predominant land use in the Coalition area. Of the approximate total 1,057,350 acres in the Coalition, irrigated agriculture comprises 52% (548,362 acres). There is a discrepancy between the Department of Water Resources (DWR) land use statistics and the County Agricultural Commissioner's land use statistics. Because the County Agricultural Commissioner's statistics are more recent, the Coalition uses those for the overall total of irrigated agriculture, but individual land use totals are from DWR. Wild vegetation covers 220,585 acres (20.9%) of the Coalition area and includes land cover classes such as natural riparian areas, parks, and open rangeland. Non-irrigated land uses cover 189,102 (17.9%) acres and include primarily urban land uses with some acreage in feedlots and impoundments. The remaining acres outside of the Coalition area in San Joaquin County are the Del Puerto or West Stanislaus Irrigation Districts, or are urban lands. Land use data for Alameda County is based on an aerial survey by DWR in 1993 and described agricultural lands only in the general terms of cropped (irrigated) or fallow (non-irrigated).

With respect to water quality, the impact of urban land use on water quality may be equal to the effects from agricultural land use, especially due to the rapid and ongoing growth of urban centers. The rapid growth of cities such as Lodi, Stockton, Lathrop, and Manteca on the east side of the Delta and Antioch, Sand Hill, Knightsen, and Brentwood on the west side of the Delta are consuming large amounts of irrigated agricultural land. Land designated as agricultural only a few years ago, is now covered in housing developments and shopping malls.

A variety of crops are grown within the Coalition boundaries (Table 1) and different crops are often found in regions specific to microclimate, soil type, and local farming history. A more detailed discussion of crop type is provided in the site subwatershed descriptions. In general, agriculture varies geographically as one travels from the Delta to the eastern edge of the Coalition. The peat rich Delta soils and the loamy soils of the Coalition area, combined with the regions more temperate climate, make it ideal for field and vegetable crops such as asparagus, alfalfa, feed corn, peppers, sugar beets and tomatoes, orchard crops i.e. pears, cherries, and apricots, as well as turf farms and nurseries. In the east portion of the Coalition, deciduous orchards (primarily almonds and walnuts) and wine grapes (Lodi-Woodbridge area) are the dominant crops. There are also large acreages of irrigated pasture and numerous dairy farms in the southern portion of the Coalition.

Table 1. Crops grown in the SJCDWQC region.

Crop list was assembled from the CDPR database for 2004. An "X" in the month column indicates that a pesticide application was made on that crop during that month. Since detailed land use data is not available for the portion in Alameda County, a crop list is not provided for this County.

County Name	Crop	January	February	March	April	May	June	July	August	September	October	November	December
Contra Costa													
	Alfalfa (forage - fodder) (alfalfa hay)	X	X	X	X		X		X	X	X	X	X
	Apple	X		X	X	X	X	X	X			X	X
	Apricot	X	X	X	X	X			X		X	X	X
	Artichoke (globe) (all or unspec)				X								
	Asparagus (spears, ferns, etc.)	X	X	X	X	X	X	X	X		X		
	Barley, general	X											
	Beans, succulent (other than lima)								X	X			
	Cherry	X	X	X	X	X	X	X	X		X	X	X
	Corn (forage - fodder)				X	X	X	X	X				
	Corn, human consumption	X	X	X	X	X	X	X	X	X	X		
	Forage - fodder grasses (all or unspec) (hay)		X	X									
	Grapes			X	X	X	X	X				X	X
	Grapes, wine	X	X	X	X	X	X	X	X	X	X	X	X
	Melons			X	X			X	X				
	Nectarine	X	X	X	X	X			X		X	X	X
	N-grnhs grwn cut flwrs or greens	X	X	X	X	X	X	X	X	X	X		X
	N-grnhs grwn plants in containers	X	X	X	X	X	X	X	X	X	X	X	X
	N-outdr container/fld grwn plants	X	X	X	X	X	X	X	X	X	X	X	X
	N-outdr grwn cut flwrs or greens						X						
	Oats (forage - fodder)		X	X									
	Oats, general	X											
	Olive (all or unspec)					X	X	X	X	X	X		X
	Onion (dry, spanish, white, yellow, red, etc.)			X	X					X		X	
	Orchards (fruit/nut etc)				X				X	X		X	X
	Pastures (all or unspec)	X	X	X			X						
	Peach	X	X	X	X	X	X		X	X	X	X	X
	Pear	X				X		X					
	Peppers (fruiting vegetable), (bell,chili, etc.)			X	X								
	Plum (includes wild plums for human consumption)	X	X	X		X						X	X
	Potato (white, irish, red, russet)		X	X		X	X	X	X	X			

County Name	Crop	January	February	March	April	May	June	July	August	September	October	November	December
	Pumpkin									X			
	Ryegrass, perennial (forage - fodder)		X	X									
	Soil application, preplant-outdoor (seedbeds, etc.)	X		X								X	
	Sorghum/milo general						X						
	Squash (all or unspec)				X			X	X	X		X	
	Strawberry (all or unspec)			X				X					
	Tomato			X	X	X	X	X	X	X	X		
	Tomatoes, for processing/canning	X		X	X	X	X	X					
	Walnut (english walnut, persian walnut)	X		X	X	X	X	X	X	X	X	X	X
	Wheat (forage - fodder)	X	X	X									
	Wheat, general	X	X		X	X							
San Joaquin													
	Alfalfa (forage - fodder) (alfalfa hay)	X	X		X			X	X				X
	Almond	X	X		X			X	X				X
	Apple	X	X		X			X	X				X
	Apricot	X	X		X			X	X				X
	Asparagus (spears, ferns, etc.)	X	X		X			X	X				X
	Barley (forage - fodder)	X											
	Barley, general	X	X										
	Basil (bush, garden, sweet)				X				X				
	Beans (all or unspec)				X			X	X				
	Beans, dried-type	X	X		X			X	X				X
	Beans, succulent (other than lima)				X			X	X				
	Beets, general												X
	Blueberry	X											
	Broccoli				X				X				X
	Cabbage							X	X				
	Cantaloupe								X				
	Carrots, general	X	X		X			X					
	Cauliflower	X	X		X								
	Celeriac (celery root)							X					X
	Celery, general							X	X				X
	Cherry	X	X		X			X	X				X
	Chestnut								X				X
	Christmas tree plantations	X			X				X				
	Clover (all or unspec) (forage - fodder)												X
	Corn (forage - fodder)	X	X		X			X	X				X
	Corn, human consumption	X	X		X			X	X				
	Cotton, general				X			X	X				
	Cucumber (pickling, chinese, etc.)							X	X				
	Endive (escarole)								X				

County Name	Crop	January	February	March	April	May	June	July	August	September	October	November	December
	Forage - fodder grasses (all or unspec) (hay)	X	X					X					X
	Grapes	X	X		X			X	X				X
	Grapes, wine	X	X		X			X	X				X
	Kiwi fruit	X	X										
	Lettuce, leaf (all or unspec)		X						X				X
	Melons				X			X	X				
	Nectarine	X	X		X			X	X				X
	N-grnhs grwn cut flwrs or greens		X					X	X				
	N-grnhs grwn plants in containers	X	X		X			X	X				X
	N-grnhs grwn trnsplnt/prpgtv mtrl	X	X		X				X				X
	N-outdr container/fld grwn plants	X	X		X			X	X				X
	N-outdr grwn trnsplnt/prpgtv mtrl				X			X	X				
	Nut crops, nut trees (all or unspec)		X										
	Oats (forage - fodder)	X	X					X					X
	Oats, general	X	X		X								X
	Olive (all or unspec)	X			X			X	X				
	Onion (dry, spanish, white, yellow, red, etc.)	X	X		X			X	X				
	Onions (green)	X	X		X								X
	Parsley (leafy vegetable)		X					X	X				X
	Pastures (all or unspec)	X	X						X				X
	Peach	X	X		X			X	X				X
	Pear	X	X		X			X	X				X
	Pecan		X		X				X				X
	Peppers (fruiting vegetable), (bell,chili, etc.)		X		X			X	X				
	Persimmon	X			X								
	Pistachio (pistache nut)	X	X		X								
	Plum (includes wild plums for human consumption)	X	X		X			X	X				X
	Potato (white, irish, red, russet)				X			X	X				
	Pumpkin				X			X	X				
	Rice (all or unspec)				X			X					
	Rye (all or unspec)		X										
	Ryegrass, perennial (forage - fodder)	X											
	Safflower, general		X		X				X				X
	Sorghum/milo general							X	X				
	Squash (all or unspec)		X					X	X				
	Squash (summer)								X				
	Squash (winter) (hubbard squash, calabaza, etc.)							X	X				
	Stone fruits (all or unspec)		X		X								

County Name	Crop	January	February	March	April	May	June	July	August	September	October	November	December
	Strawberry (all or unspec)				X			X	X				
	Sudangrass (forage - fodder) (sorghum sudanese)							X	X				
	Sugarbeet, general							X					
	Tomato	X	X		X			X	X				X
	Tomatoes, for processing/canning	X	X		X			X	X				X
	Vegetables (all or unspec)				X								
	Walnut (english walnut, persian walnut)	X	X		X			X	X				X
	Watermelons				X			X	X				
	Wheat (forage - fodder)	X	X										
	Wheat, general	X	X		X			X					X

Climate

Summer temperatures are usually hot in the upper portions of the Valley, ranging from the mid 80's to mid 90's (^{o}F) for average high temperatures and the mid to upper 50's for average summer low temperatures. In the summer, the Delta and vicinity are subject to pulses of cool coastal air that can provide relief from summertime highs and allow for the farming of cooler crops. The upland areas are slightly cooler at night but generally remain hot throughout the summer. In the winter, temperatures are usually moderate in the Valley with average high temperatures in the mid to upper 50's and average low temperatures in the low 40's. Freezing, although less likely in the Delta region, does occur preventing the farming of perennial crops susceptible to frost. Annual precipitation on the valley floor in the Coalition area is variable, averaging 14-16 inches per year (City of Stockton). The southwestern portion of the Coalition region is in a rain shadow area and receives approximately half the rainfall of the rest of the Coalition region. Rainfall occurs predominantly during the winter and is heterogeneously distributed throughout this period (typical for a Mediterranean climate). Winter seasons are characterized by several small storms with one or two major events (increased rain due to several larger storms) providing the bulk of the precipitation. December, January and February are historically the months with greatest precipitation. There appears to be no discernible pattern as to when during the winter these large storms occur.

Soils

Soils maps reveal a complicated mosaic of soil types in the Coalition area. Generally, the Coalition area outside the Delta has sandy, well-drained soils. Soil type combines with other factors such as slope, soil saturation, rainfall/irrigation water amount, and drainage patterns to control runoff. Soils in the Delta contain high peat content and many Delta islands are now below sea level, a condition that has led to an intricate system of drains and pumps in this region. ArcGIS soils coverages have been provided previously and will not be provided as part of this document.

Hydrology

As previously indicated, there are several main rivers that cross the Coalition area from east to west. These rivers have complex hydrologic systems due to both seasonal influence of precipitation and management systems for water use (reservoirs, basin transfers, hydropower, municipal and irrigation supply, and anadromous fisheries). In general, flows are greatest during the winter and spring due to wintertime precipitation and subsequent springtime snowmelt. Summertime flows are now greater than they have been in the past due to reservoir releases during the dryer months of the year. The numerous small creeks that have their headwaters in the foothills and western portion of the Sierra Nevada mountain range are primarily ephemeral and historically have had no flow from early summer through the first rains of the winter. Current flow occurs as a result of irrigation return.

The drainages described in each site subwatershed include the main tributaries and the intermediate to small sized water bodies where in general water flow is maintained throughout the year. The exception to this is that flows may be lacking in the late summer and early autumn prior to the onset of the winter rains.

There is an increased propensity for runoff with increased slope, soil water saturation, and volume of water. These conditions arise primarily due to large amounts of rainfall and are more likely in the relatively greater sloped valley margins. During the winter, runoff is drained through the myriad of creeks, rivers and drains for flood management and may be subject to efforts of larger geographic flood control programs. Runoff can also occur during the irrigation season if water entering the field is greater than the amount that can infiltrate the soil.

In Delta islands, water is pumped in and out of supply and drainage canals. Ordinarily, drains pumping water off the islands could be turned off thus eliminating runoff. This cannot occur because water is continually entering the islands through groundwater recharge (essentially seepage from the greater in elevation water source on the river side of the levee) thus requiring off-island draining.

Valuable Aquatic Resources

Aquatic resources for water bodies within the Coalition area have been defined in part as those assigned as beneficial uses (BU) by the CVRWQCB. Using the tributary rule, BUs are applied to tributaries based on the currently assigned BU of the major downstream receiving water body (Table 2). Important aquatic resources exist in the Coalition area, including municipal and agricultural water use, cold water and warm water stream aquatic habitat, wetlands and fisheries resources. Wetlands are associated with riparian areas along many of the water bodies in the region. Several fisheries are considered important in the Coalition area including steelhead trout and Chinook salmon.

Steelhead trout (*Oncorhynchus mykiss*) were common in the region prior to the construction of the dams on all of the major tributaries of the San Joaquin River. Once the dams were constructed, historic spawning grounds were eliminated and with them, most of the wild salmonids in the Valley. Currently, no permanent steelhead stocks exist in the drainages of the Valley despite occasional reports of fish in the Tuolumne and Merced Rivers.

Chinook salmon (*Oncorhynchus tshawytscha*) are present in the San Joaquin River system and are found in all major tributaries in the region. All of the major tributaries are considered to be impaired for salmonid spawning and/or migration habitat as is the main stem of the San Joaquin River (Table II-1 of the Sacramento/San Joaquin River Basin Plan). A large hatchery exists on the Mokelumne River to supplement salmon populations impacted by Comanche Reservoir.

Table 2. Site subwatershed drainage and beneficial uses.

Major rivers to which each site subwatershed drains and the beneficial use for each of the major river reaches.

Site subwatershed (site name)	Immediate Downstream River	Beneficial Use of Immediate Downstream River*
Mokelumne River @ Bruella Rd	Mokelumne River[1]	2, 3, 6-14
Duck Creek @ Highway 4	Sacramento San Joaquin Delta[2]	1-12, 14, 15
French Camp Slough @ Airport Way		
Grant Line Canal near Calpack Rd		
Grant Line Canal @ Clifton Court Rd		
Kellogg Creek along Hoffman Lane		
Littlejohns Creek @ Jack Tone Rd		
Lone Tree Creek @ Jack Tone Rd		
Marsh Creek @ Concord Ave**		
Mormon Slough @ Jack Tone Road		
Roberts Island Drain @ Holt Rd		
Roberts Island Drain along House Rd		
Sand Creek @ Hwy 4 Bypass		
Terminous Tract Drain @ Hwy 12		
Unnamed Drain to Lone Tree Creek @ Jacktone Rd		

[1] Comanche Reservoir to Delta reach

[2] "Beneficial uses vary throughout the Delta and will be evaluated on a case-by-case basis" (wording from the Central Valley Region Basin Plan).

* See below Beneficial Use code list.

** Marsh Creek has been assigned only recreational beneficial uses

Beneficial Use List

Municipal and Domestic Supply - 1
Agriculture Supply (irrigation) - 2
Agriculture Supply (stock watering) - 3
Industrial Process Supply - 4
Industrial Service Supply - 5
Water Contact Recreation - 6
Non-contact Water Recreation - 7
Warm Freshwater Habitat - 8
Cold Freshwater Habitat - 9
Migration of Aquatic Organisms (warm) - 10
Migration of Aquatic Organisms (cold) - 11
Spawning, Reproduction, and/or Early Development (warm) - 12
Spawning, Reproduction, and/or Early Development (cold) - 13
Wildlife Habitat - 14
Navigation – 15

Thirty-five site subwatersheds in the Coalition area have been classified into three categories (large, intermediate or small) based on water flow and the drainage area of the site subwatershed (Table 3). The large site subwatersheds within the Coalition area are the four major rivers (San Joaquin, Mokelumne, Calaveras, and Stanislaus). In the case of the large site subwatersheds, only the portion of the entire drainage area that is within the Coalition boundaries is included in the reported site subwatershed area, and as a result the stated areas of the large site subwatersheds can be similar to or even less than some of the site subwatersheds classified as intermediate sized. Due to snowmelt and reservoir releases, the four large site subwatersheds have greater base flow than the site subwatersheds classified as intermediate or small. There are 16 intermediate sized site subwatersheds that include several locations along Bear Creek, Duck Creek, French Camp Slough, Littlejohns Creek, Lone Tree Creek, Marsh Creek, Mormon Slough, Mosher Creek, and Pixley Slough. These are primarily natural creeks and sloughs in the eastern portion of San Joaquin County or larger sloughs at the eastern edge of the Delta. The smaller site subwatersheds in the Coalition area are either Delta island drains or small natural creeks. There are hundreds of small Delta Island drains that could be designated as small site subwatersheds. However, because many of these small drains collect water from a limited number of fields, sometimes only one field, they are not designated as individual site subwatersheds in this report.

In previous documents addressing size of water bodies, some of the water bodies in Table 3 have been designated as both intermediate and small. As the Coalition refines its understanding of flow, movement of water, and boundaries of the drainage area, the categorization of each water body is reviewed. Water bodies are reclassified as appropriate based on the size of all water bodies in the Coalition region. Consequently, Kellogg Creek, Sand Creek, and Grant Line Canal were previously listed as intermediate sized water bodies, but were reclassified as small in the December 2006 SAMR. That classification has been retained for this SAMR.

Figure 3 provides the size of currently sampled site subwatersheds within the Coalition region. Site subwatersheds are designated by size and are provided by county in Figures 4-6 below. Due to the size limitation of this document, the detail shown on the maps is minimal. Size delineation is provided on Figure 3. Maps are available as an ArcGIS coverage and can be manipulated to provide any level of detail desired.

Table 3. Site subwatershed size designations.

Site subwatersheds are classified as large, intermediate and small based on the size of the water body. The list below indicates both currently sampled sites and proposed sites, which are representative of waters in the Coalition region. The sample sites are ideally located at the farthest downstream location of a primarily agricultural area. The site subwatershed is formed from the location of the sample site.

Site Subwatershed	Size Designation
Calaveras River @ Belotta Intake	Large
Calaveras River @ Eight Mile Rd.	Large
Calaveras River @ North Alpine Rd.	Large
Calaveras River @ Shelton Rd.	Large
Mokelumne River @ Bruella Rd.	Large
Bear Creek @ Hwy 99	Intermediate
Bear Creek @ Lower Sacramento Rd.	Intermediate
Bear Creek @ N. Alpine Rd.	Intermediate
Duck Creek @ Highway 4	Intermediate
French Camp Slough @ Airport Way	Intermediate
Littlejohns Creek @ Jack Tone Rd.	Intermediate
Lone Tree Creek @ Austin Rd.	Intermediate
Lone Tree Creek @ Brennan Rd	Intermediate
Lone Tree Creek @ Jack Tone Rd.	Intermediate
Marsh Creek @ Balfour Rd.	Intermediate
Marsh Creek @ Concord Ave.	Intermediate
Marsh Creek @ Marsh Creek Rd Lower	Intermediate
Marsh Creek @ Marsh Creek Rd Upper	Intermediate
Mormon Slough @ Jack Tone Rd.	Intermediate
Mosher Creek @ Eight Mile Rd.	Intermediate
Pixley Slough @ Eight Mile Rd.	Intermediate
Grant Line Canal near Calpack Rd	Small
Grant Line Canal @ Clifton Court Rd	Small
Kellogg Creek @ Hoffman Rd	Small
Kellogg Creek @ Hwy 4	Small
Paddy Creek @ Hibbard Rd	Small
Potato Slough @ Hwy 12	Small
Roberts Island Drain @ Holt Rd	Small
Roberts Island Drain along House Rd	Small
Sand Creek @ Hwy 4 bypass	Small
Terminous Tract Drain @ Hwy 12	Small
Terminous Tract @ field drain off Glasscock Rd	Small
Terminous Tract on Hwy 12 west of Guard Rd	Small
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd.	Small
Unnamed Drain to Walthall Slough – Nile Rd. @ S. Airport Way	Small

Figure 3. Site subwatershed size designation showing only 2008 storm site subwatersheds in the Coalition region.

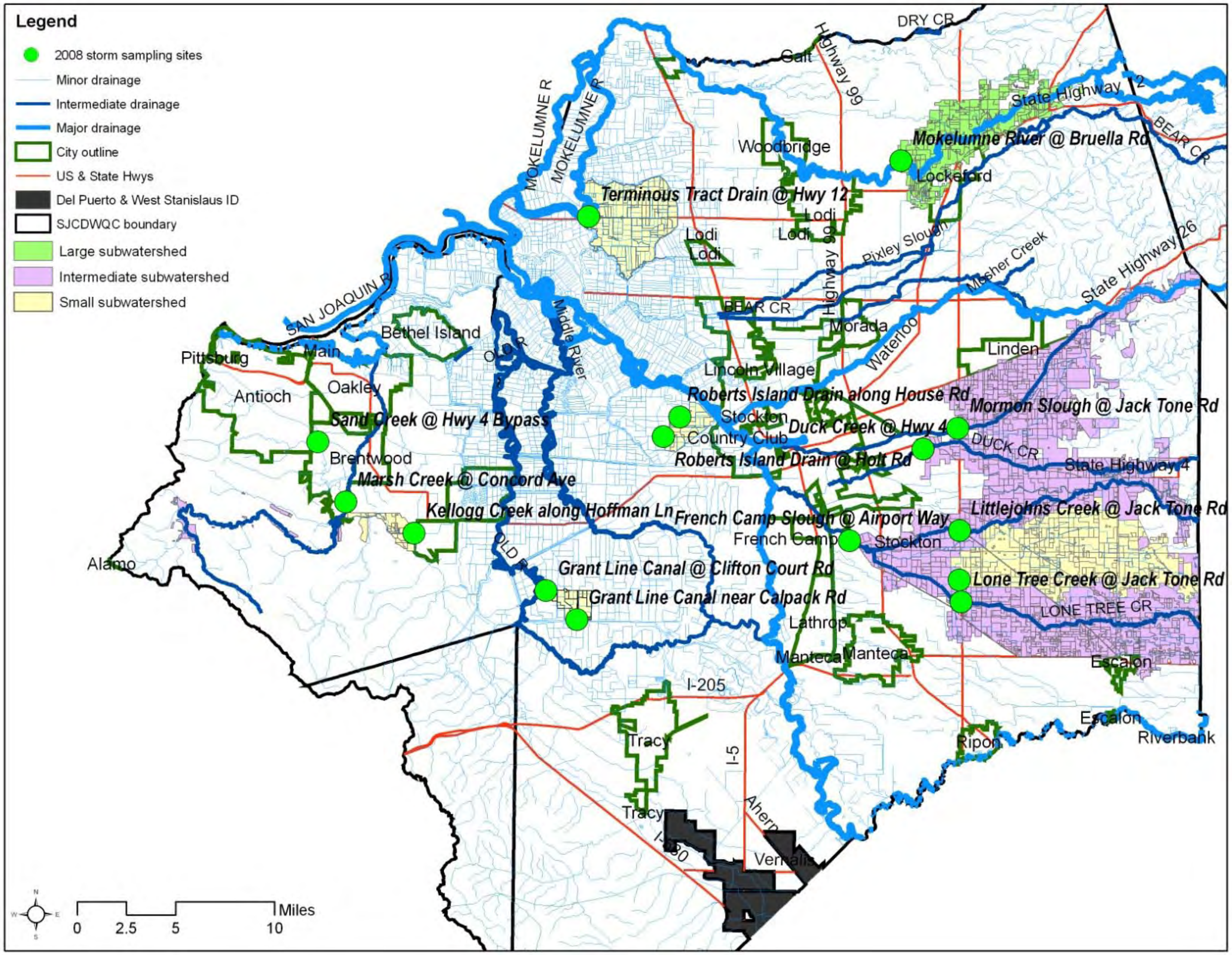


Figure 4. Site subwatershed size designation – Contra Costa County.

The legend for this map is provided in Figure 3 above.

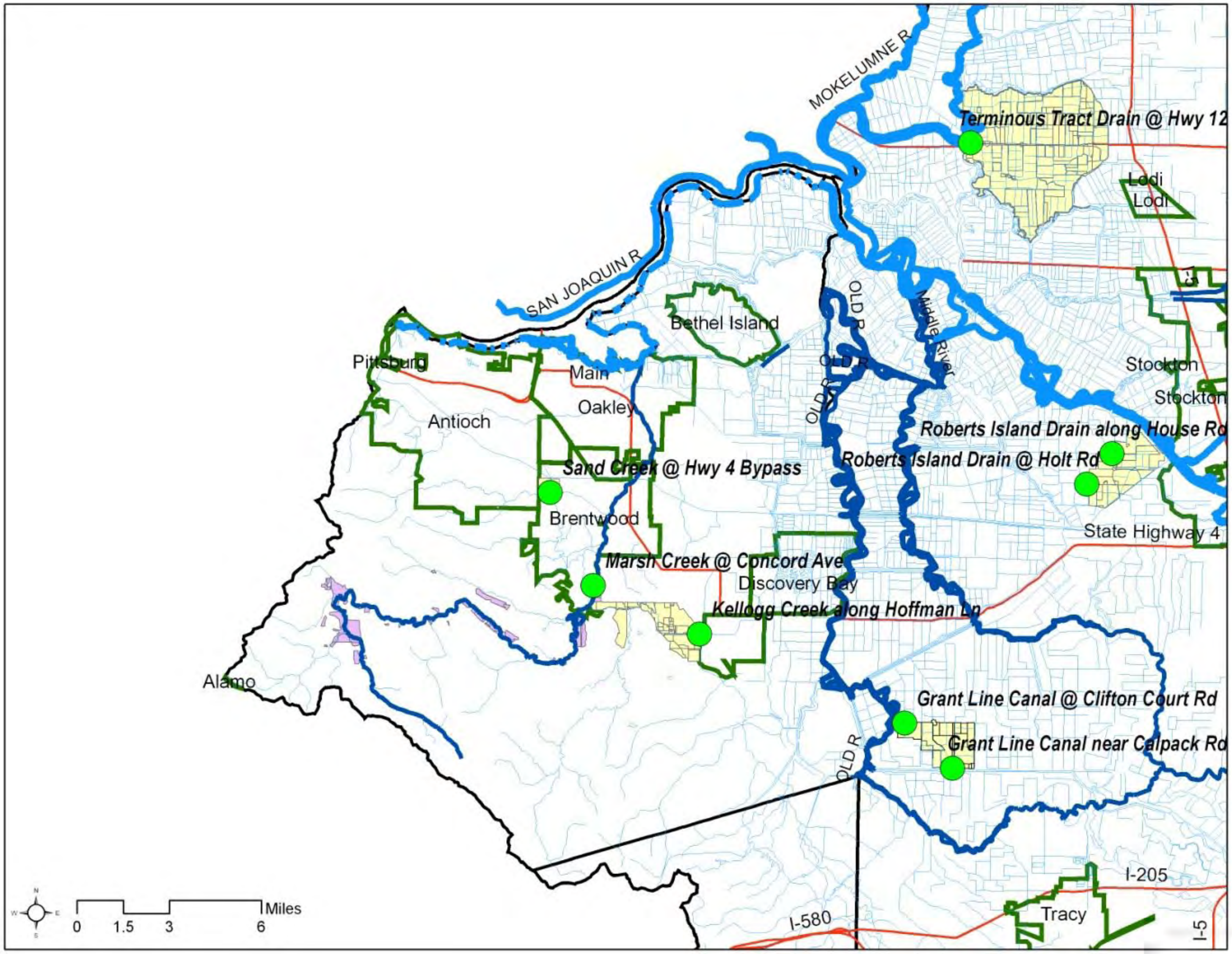


Figure 5. Site subwatershed size designation – northern San Joaquin County.

The legend for this map is provided in Figure 3 above.

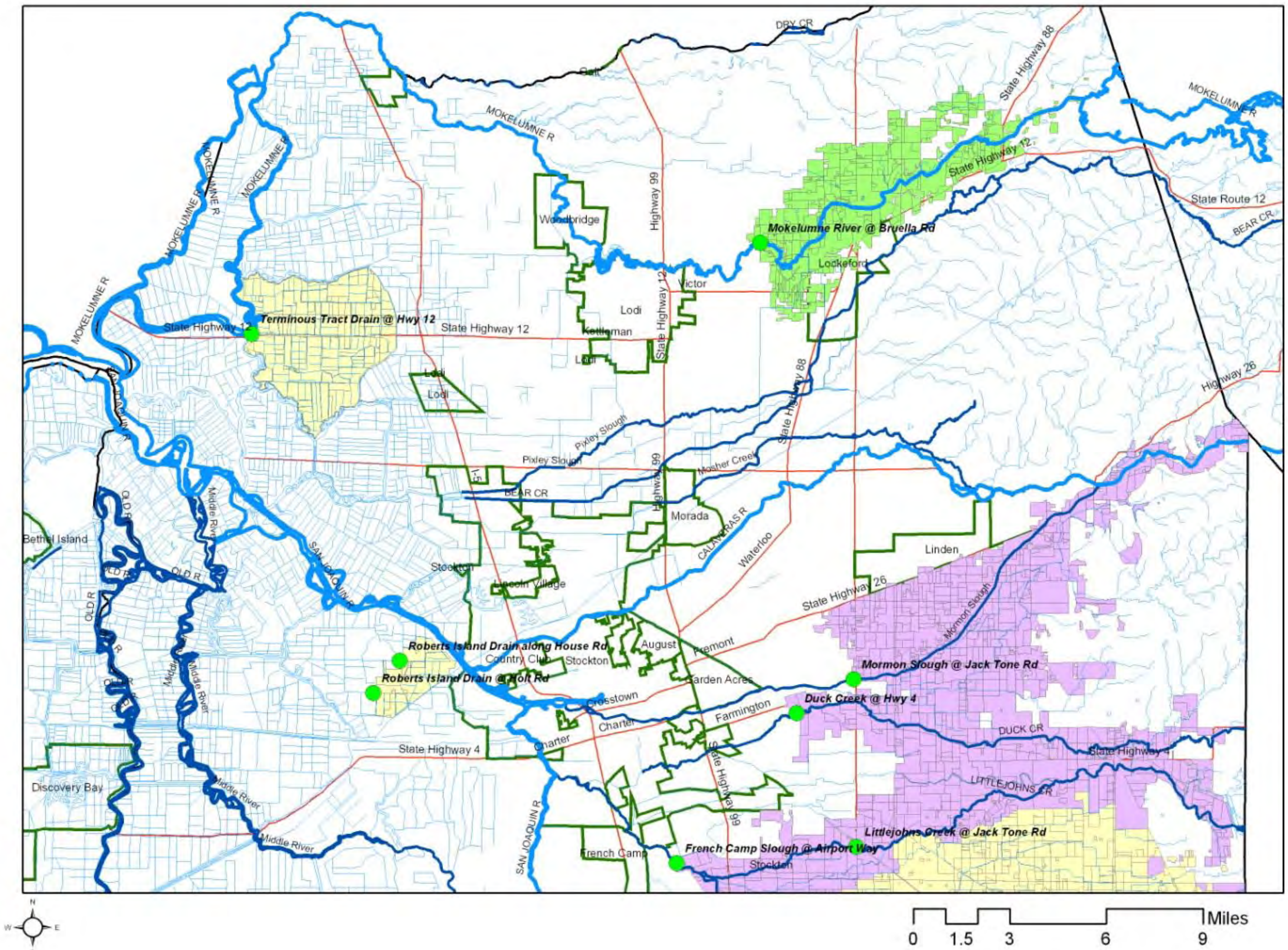
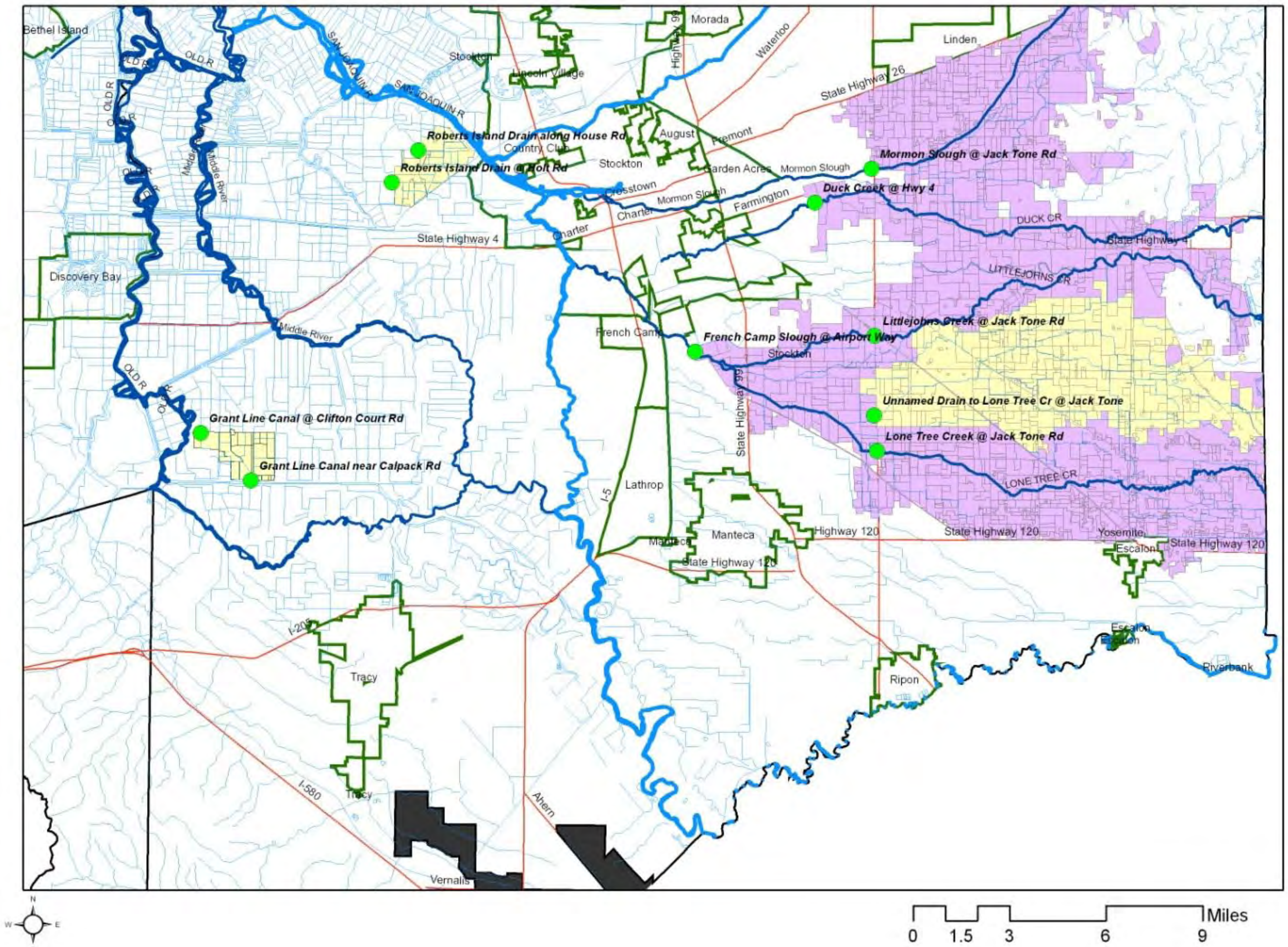


Figure 6. Site subwatershed size designation – southern San Joaquin County.

The legend for this map is provided in Figure 3 above.



Monitoring Objectives

History of Coalition Monitoring

Coalition ambient water and sediment quality monitoring has been conducted in the SJCDWQC region since the inception of the Irrigated Lands Program in 2003. Each year both the number of sites monitored and the constituents analyzed have grown. In 2004 samples were collected from six sites and were sent to laboratories to test for nine total constituents/analytes as well as toxicity testing. By 2007, 15 monitoring sites were sampled and over 50 total analytes tested in addition to toxicity. In addition, the Coalition has conducted upstream sampling in 2005 and 2007 to help determine sourcing. Table 4 illustrates the sites monitored during each the storm and irrigation seasons across years of sampling.

Table 4. Sample sites and years monitored.

A blank cell indicates that no sampling occurred at that site during the specified season.

StationName	2004	2005		2006		2007		2008
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm
Calaveras River @ Belota Intake	x							
Delta Drain- Terminous Tract off Glasscock Rd		x	x	x				
Delta Drain- Terminous Tract off Guard Rd		x	x	x				
Duck Creek @ Hwy 4	x				x	x	x	x
French Camp Slough @ Airport Way		x	x	x	x	x	x	x
Grant Line Canal @ Clifton Court Rd		x	x	x	x	x	x	x
Grant Line Canal near Calpack Rd		x	x	x	x	x	x	x
Kellogg Creek @ Hwy 4		x	x	x				
Kellogg Creek along Hoffman Ln			x	x	x	x	x	x
Littlejohns Creek @ Jack Tone Rd	x	x	x	x	x	x	x	x
Lone Tree Creek @ Bernnan Rd			x	x				
Lone Tree Creek @ Jacktone Rd	x	x	x	x	x	x	x	x
Marsh Creek @ Balfour Ave		x	x	x				
Marsh Creek @ Concord Ave			x	x	x	x	x	x
Marsh Creek @ Marsh Creek Rd Upper*							x	
Marsh Creek @ Marsh Creek Rd Lower*							x	
Mokelumne River @ Bruella Rd	x	x	x	x	x	x	x	x
Mokelumne River @ Fish Hatchery*			x					
Mormon Slough @ Jack Tone Rd					x	x	x	x
Potato Slough @ Hwy 12	x	x	x	x				
Roberts Island Drain @ Holt Rd					x	x	x	x

StationName	2004	2005		2006		2007		2008
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm
Roberts Island Drain along House Rd					x	x	x	x
Sand Creek @ Hwy 4 Bypass					x	x	x	x
Terminous Tract Drain @ Hwy 12		x	x	x	x	x	x	x
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd					x	x	x	x

*Upstream sampling of normal monitoring locations conducted for source identification.

Storm Season Monitoring 2008

Monitoring Characterization

Coalition monitoring is conducted in both the winter storm runoff season and the summer irrigation season. This report covers only monitoring conducted between the months of October 2007 and March 2008, during the storm season. The winter storm season sampling is designed to characterize the discharge from irrigated agriculture as a result of storm runoff. Normal monitoring during the storm season is triggered by a storm event of 0.5 inches of rain or greater in 24 hours, after the dormant season sprays occur. Below is a description of the storm event that occurred for the 2008 monitoring season.

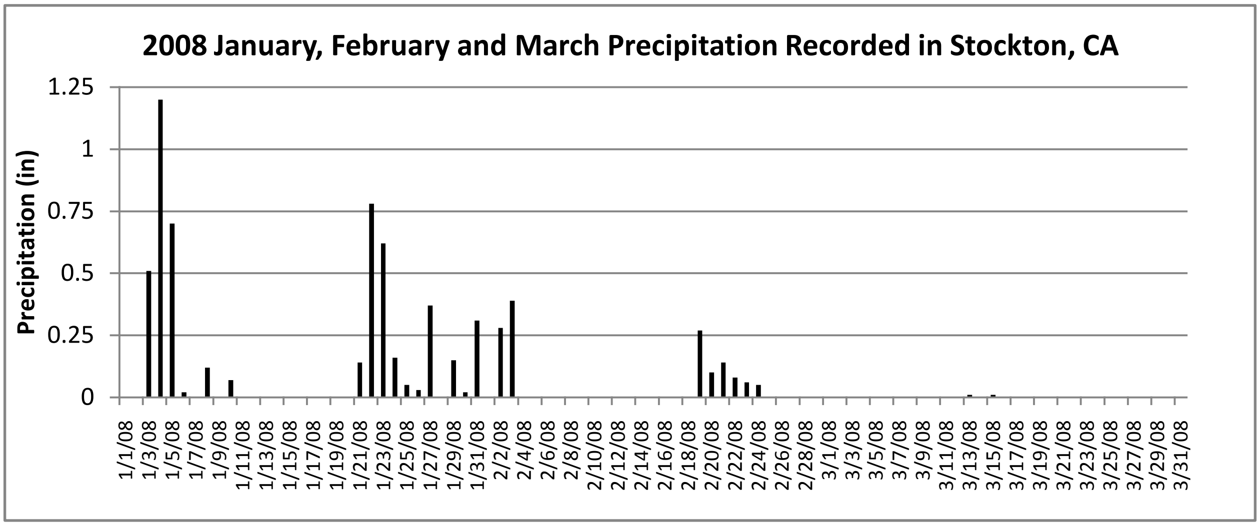
The first storm sampling event for the SJCDWQC took place on January 23, 2008. This storm was separated from the previous substantial precipitation between January 3-5, 2008 by twelve days of zero recorded rainfall, which allowed ample time for farmers to apply dormant season pesticides and herbicides. Rainfall during the precipitation event varied over the geographic sample area but surpassed the 0.5 inches within 24 hours trigger on both January 22, the day prior to sampling, and January 23, the day samples were collected. During the 48 hours prior to sampling, 0.92 inches of rain fell in Stockton, CA, which produced measurable runoff across the region (Figure 7). This storm event was the second substantial rain of 2008 during a wet January but the first after dormant sprays. The statewide average of 6.02 inches of rainfall made January 2008 the 24th wettest January in the 113 years of the California Climate Tracker. During the sampled storm the sub-tropical moisture landed on coastal central California, crossed the southern San Joaquin Valley and spun north along the foothills of the Sierra Nevada. It then returned to the Valley and continued pushing north. For the 12 days after sampling rain continued to fall across the region, with an additional 2.38 inches recorded in Stockton, including the day samples were collected.

Runoff from the next rain event (February 20-24) was not captured as the precipitation did not meet the trigger (Figure 7). It was anticipated, based on previous years winter storm patterns, that additional storm events exceeding the sampling trigger would occur during March. However, the dry weather persisted into April and samples were not collected for a second storm event.

Storm season sediment samples are collected during the storm season as soon as water levels are safe enough to access and flows are low enough to allow collection of sediment without it being flushed downstream. Due to the dry weather after January, the Coalition was able to collect sediment samples on March 18, 2008.

Figure 7. Local precipitation conditions before and after the first storm sampling event on 1/23/08.

All data recorded in Stockton, CA and reported on weatherunderground.com.



Monitoring Objectives

The objectives of the SJCDWQC monitoring program are to:

- Determine the concentration and load of waste in discharges to surface waters.
- Evaluate compliance with existing narrative and numeric water quality objectives to determine if implementation of additional management practices is necessary to improve and/or protect water quality.
- Assess the impact of waste discharges from irrigated agriculture to surface water.
- Determine the degree of implementation of management practices to reduce discharge of specific wastes that impact water quality in watersheds within the coalition region.
- Determine the effectiveness of management practices and strategies to reduce discharges of wastes that impact water quality.

In order to achieve the objectives listed above, the SJCDWQC monitored water quality at 15 sites in the Coalition region during the 2008 storm runoff season. The Coalition sampled for numerous water quality variables and constituents including 39 pesticides, *E. coli*, physical parameters (total dissolved solids, color and turbidity), eight metals, total organic carbon, nutrients, field parameters (dissolved oxygen, pH, electrical conductivity), water toxicity to three test species including *Ceriodaphnia dubia*, *Pimephales promelas* and *Selenastrum* *capricornutum* and sediment toxicity to *Hyalella azteca*. Monitoring constituents are established by the MRP (Order No. R5-2005-0833) and are discussed in more detail below.

Only one site (Kellogg Creek along Hoffman Ln) was not sampled due to dry conditions on January 23, 2008 (documented in the section on Precision and Accuracy). This site was documented by photographs which are available on request. Sediment sampling occurred on March 18, 2008 with one rainfall event (not substantial enough to trigger sampling) occurring between this time and the previous water sampling event on January 23, 2008. Duck Creek @ Hwy 4 contained water however it was non-contiguous. Standard operating procedures for the collection of samples states that samples will be collected only if there is contiguous water. Therefore, based on standard operating procedures (SOPs), sediment was not analyzed for toxicity from this site. All other sites had contiguous water and were sampled and analyzed for sediment toxicity.

Pesticides and Toxicity

Pesticides can end up in the water column or sediment as a result of applications that occur during the winter including dormant and pre-emergent sprays. Runoff from fields can move sediment and chemicals to surface waters. Water collected for chemical analysis can identify those chemicals and concentrations can be compared to numeric and narrative water quality trigger limits to determine if exceedances have occurred. Toxicity testing is complementary to chemical analyses and can provide an independent and more direct assessment of the level of impairment in the water body. The objective of the Coalition is to use the toxicity testing along with water chemistry to assess the impact of discharges from irrigated agriculture on waterbodies in the Coalition region.

Nutrients and Physical Parameters

Excessive nutrients can cause eutrophication of surface waters as well as elevated TOC, color content, and turbidity. All of these factors can independently cause impairment of surface waters. However, sources of nutrients, organic carbon, color, and low DO are difficult to determine. The Coalition's objective is to determine if exceedances are occurring and to determine if potential sources can be identified through analysis of monitoring data. If current monitoring data are not sufficient, the Coalition may conduct further investigations to identify sources. Such investigations may include special studies where they are determined to be cost effective. By understanding the sources of constituents responsible for the exceedances, the Coalition can properly recommend management practices to address nutrient and physical parameter exceedances.

Field Parameters

Much like physical parameters, exceedances of water quality triggers for pH, DO, and EC are difficult to track to sources. All of these parameters are non-conserved meaning that they can increase or decrease in concentration as water moves downstream. These parameters are the responses to processes occurring in the water column and sediment, and can vary diurnally. As with nutrients and physical parameters, the Coalition's objective is to determine if exceedances are occurring, and to investigate potential sources through analysis of monitoring data and special studies, where they are cost effective. For example, the Coalition collected additional samples for biological oxygen demand (BOD) during 2007 to better understand the causes of low DO. By understanding the sources of constituents that may affect field parameters, the Coalition can properly recommend management practices to address the exceedances.

E. coli

E. coli inhabits the intestinal tracts of animals and is voided in fecal material. *E. coli* may persist in the presence of oxygen in the environment for periods of time after being voided. The bacteria are also known to reproduce and magnify in the environment. However, conditions under which this occurs are not well understood and require additional research. Any species of vertebrate that voids feces can contribute *E. coli* to surface waters, including humans, domesticated animals such as pets (dogs and cats primarily), cows and chickens, waterfowl (ducks and geese), raccoons, otters, ground squirrels, feral pigs, and in some locations deer. Consequently, there may be a large amount of bacteria in any environmental sample that is collected.

E. coli from humans can enter aquatic systems from leaky septic systems, leaky sanitary sewer lines, improperly treated discharge from waste water treatment plants, application of biosolids to agricultural land, and direct inputs from individuals who defecate in or near water bodies. Input from cows can occur from dairies, grazing in irrigated pastures, and various manure sources. *E. coli* from chickens can enter from poultry operations or manure sources. Irrigated agriculture is responsible for management if *E. coli* contamination occurs due to irrigated pasture or manure applications for fertilizer.

Metals

The Coalition samples for four basic classes of metals; 1) those that are naturally elevated because of underlying geologic materials (boron, selenium), 2) those that are applied by agriculture (copper, zinc, nickel), 3) those that may be legacy pesticides but also have numerous nonagricultural sources (lead, arsenic), and 4) those that are found solely as a result of nonagricultural anthropogenic sources (cadmium). These categories are not mutually exclusive and in fact, all metals belong to the first category. For example, nickel is a plant micronutrient that may be incorporated into fertilizer mixes, although normally there is a sufficient quantity of nickel in soils to supply the needs of crops. As a result, although it may be applied by agriculture, exceedances would be expected to primarily a result of natural weathering of soils.

Natural weathering of geologic materials can release to surface waters other metals and metalloid elements such as selenium, arsenic, and boron. Selenium salts are naturally elevated in the parts of the southwestern San Joaquin Valley and are transported during storm runoff to surface waters in other parts of the valley. These salts are so problematic that there is a prohibition of discharge of irrigation return flows in some locations. Boron is naturally elevated particularly in the coastal mountain ranges and runoff brings boron from these mountains to the Valley floor. Arsenic appears also to be naturally elevated in several locations in the Valley. Zinc and nickel are also found in soils and can be found in surface waters at levels that reflect background concentrations. Both of these elements can be applied by agriculture as well, and the difference between applications and natural weathering must be understood to properly manage the amounts reaching surface waters. Understanding background levels of these elements will be an important task for the Coalition when trying to understand the impacts of agricultural inputs to surface waters.

While all other metals can be released as a result of the weathering of geologic materials, elevated levels of most metals are a result of anthropogenic inputs. Lead was used as a pesticide during the last century but was used in smaller and smaller amounts over the last several decades before being prohibited in the 1990s. Lead was also used in gasoline until the early 1980s when it was replaced by other fuel oxygenates, and lead-based paint was routinely used until the latter parts of the last century. Lead is also a component of batteries, and is the material in solder in numerous electronic devices including televisions, computers, and cell phones. These sources can be distinguished through sophisticated analytical tests that are beyond the capabilities of the Coalition. Copper is routinely used by agriculture on a number of crops and could be found in surface waters as a result of applications. Additional sources include road surfaces where wearing of brake pads can result in substantial loading to surface waters.

Because fertilizer applications and the micronutrient constituents included in the mix are not reported, there is no way the Coalition can distinguish between natural and anthropogenic sources with monitoring data. Several of these metals can be identified to source using sophisticated analytical equipment and techniques, but these tests are beyond the capabilities of the Coalition. Consequently, the Coalition will use monitoring data to determine if exceedances are occurring, and will attempt to establish background concentrations of some metals in surface waters to determine if concentrations are a result of natural or anthropogenic inputs to the water. In addition, if it is concluded that it is necessary to determine if the metals are bioavailable, additional analyses may be used to determine the amount of soluble metals as compared to particulate bound metals.

Sampling Site Descriptions

The site names, codes and locations of all sites monitored during the 2008 storm season are provided in Table 5. A narrative description of each site subwatershed with respect to hydrology and agricultural production follows below.

Table 5. SJCDWQC storm season 2008 sampling locations.

Site Name	Station Code	Latitude	Longitude
Duck Creek @ Hwy 4	531XDCAHF	37.9491	-121.1810
French Camp Slough @ Airport Way†	531SJC504	37.8817	-121.2493
Grant Line Canal near Calpack Rd†	544XGLCCR	37.8205	-121.4999
Grant Line Canal @ Clifton Court Rd†	544XGLCAA	37.8414	-121.5288
Kellogg Creek along Hoffman Ln†	544XKCAHL	37.8819	-121.6522
Littlejohns Creek @ Jack Tone Rd†	531XLCAJR	37.8896	-121.1461
Lone Tree Creek @ Jack Tone Rd†	531XLTCJR	37.8376	-121.1438
Marsh Creek @ Concord Ave†	544XMCACA	37.9039	-121.7163
Mokelumne River @ Bruella Rd†	531XMRABR	38.1601	-121.2051
Mormon Slough @ Jack Tone Rd	544MSAJTR	37.9647	-121.1488
Roberts Island Drain @ Holt Rd	544RIDAHT	37.9556	-121.4223
Roberts Island Drain along House Rd	544RIDAHR	37.9702	-121.4074
Sand Creek @ Hwy 4 Bypass	544SCAHFB	37.9475	-121.7430
Terminous Tract Drain @ Hwy 12†	544XTTHWT	38.1166	-121.4936
Unnamed Drain to Lone Tree Cr @ Jack Tone Rd	531UDLTAJ	37.8536	-121.1457

† Sites that have been monitored for at least two years

Site Subwatershed Descriptions

The Coalition sampled a total of 15 site subwatersheds as part of normal monitoring during the 2008 storm season. No management plan or special project monitoring was conducted during the 2008 storm season. Descriptions of the site subwatersheds for all sample sites are provided below alphabetically.

Duck Creek @ Highway 4 (10,777 irrigated acres) – This site is located just to the east of the city of Stockton. Duck Creek drains a section of southern San Joaquin County between Stockton and the Lone Tree Creek site subwatershed. During the summer flow is typically low in the creek. The creek channel was dredged over several months early in the 2007 irrigation season. The predominant land uses for irrigated agriculture are field crops and irrigated pasture. There is also a relatively large amount of deciduous nuts in the site subwatershed, and truck farm/nursery and berry crops are also grown.

French Camp Slough @ Airport Way (68,502 irrigated acres) – The main water bodies draining this site subwatershed are Littlejohns Creek and Lone Tree Creek, which merge to form French Camp Slough. This site was selected as a downstream companion site to the Littlejohns Creek @ Jack Tone Road and Lone Tree Creek @ Jack Tone Road sites. These water bodies drain agricultural land to the east of Manteca and Stockton and eventually flow through urban areas prior to their discharge to the San Joaquin River. This site represents all of the major types of agriculture present in the Coalition region including field crops, orchards, grains and hay, vineyards as well as irrigated pasture.

Grant Line Canal near Calpack Road (1,676 irrigated acres) – This site is located on the south west section of Union Island. The site is adjacent to Grant Line Canal at a pumping station and drains fields immediately north and east. The crops grown are primarily alfalfa, field crops, tomatoes and grain.

Grant Line @ Clifton Court Road (756 irrigated acres) – This site is located on the southwest section of Union Island. The site is west of the Grant line Canal @ Calpack Rd. site immediately south of Clifton Court and drains fields east and south. The crops are primarily alfalfa, field crops, tomatoes and grain.

Kellogg Creek along Hoffman Lane (2,116 irrigated acres) – This site is upstream from Kellogg Creek @ Hwy 4 which was sampled in 2004 and 2005. Kellogg Creek @ Hwy 4 is no longer sampled because of large urban inputs. Deciduous nuts are the predominant crop grown in the site subwatershed along with nursery, berry, and some field crops.

Littlejohns Creek @ Jack Tone Road (12,356 irrigated acres) – This site is upstream from the French Camp Slough @ Airport Way site. The crops grown in the site subwatershed represent all of the major types of agriculture present in the Coalition region including field crops, orchards, grains, and vineyards as well as irrigated pasture.

Lone Tree Creek @ Jack Tone Road (22,359 irrigated acres) – This site is upstream from the French Camp Slough @ Airport Way site. This site drains a large portion of the southern SJCDWQC region and confluences downstream with Littlejohns Creek and eventually French Camp Slough, flowing through urban areas before emptying into the Delta. The main agricultural land use upstream consists of deciduous nuts, field crops, irrigated pastures and dairies.

Marsh Creek @ Concord Ave (230 irrigated acres) – Located on the southern edge of Brentwood, this site drains primarily deciduous nuts crops immediately upstream. Marsh Creek is fed by Marsh Creek Reservoir and also by Marsh Creek upstream of the reservoir. Land use upstream of the reservoir has a small amount of deciduous nut and fruit (approx. 45 acres) and approximately 220 acres of grains and hay but it is largely represented by urban use (approximately 1,000 acres).

Mokelumne River @ Bruella Road (8,671 irrigated acres) – Upstream agriculture is primarily vineyards although some orchards are immediately adjacent to the site. This site integrates the signal from a relatively large area.

Mormon Slough @ Jack Tone Road (21,219 irrigated acres) – This site is located to the north of and running parallel to the Duck Creek site subwatershed. Mormon Slough drains an area east of Stockton consisting of mostly agriculture and eventually flowing through Stockton and into the Delta. Vineyards and deciduous nuts make up over half of the irrigated agriculture in the site subwatershed with field crops, grains, truck farm/nursery/berry, and irrigated pasture contributing large acreages.

Roberts Island Drain @ Holt Road (1,985 irrigated acres) – This site subwatershed is a portion of Roberts Island that is drained by the pump west of the sample site along McDonald Rd. It is located south of Roberts Island Drain along House Rd. The primary agriculture upstream of the sample site is asparagus, field crops, grains, hay (alfalfa) and pasture.

Roberts Island Drain along House Road (1,541 irrigated acres) – This site subwatershed is located on the northeastern edge of Roberts Island. From the sample site, the water in the drain flows north. The primary agriculture in the site subwatershed is asparagus, followed by field crops and pasture.

Sand Creek @ Hwy 4 Bypass (185 irrigated acres) – Located northwest of Brentwood where Highway 4 Bypass crosses Sand Creek, this site subwatershed drains approximately 23 fields of deciduous nuts, fruits, grains and hay. The Roddy Ranch Golf Club is located upstream of the sampling site off Empire Mile Rd in Horse Valley, which is adjacent to one of the tributaries of Sand Creek.

Terminous Tract drain @ Hwy 12 (9,889 irrigated acres) – This site drains all of the acreage north of State Highway 12 and most of the acreage south of the Highway on Terminous Tract. This sampling site is located near the confluence of White Slough/Potato Slough and the Mokelumne River. The primary agricultural crops are field crops, turf, grains and hay.

Unnamed Drain to Lone Tree Creek @ Jack Tone Road (23,051 irrigated acres) – This site subwatershed is located to the north of the Lone Tree Creek site subwatershed and south of Littlejohns Creek. The drain forms in the eastern portion of San Joaquin County and flows west eventually confluencing with Lone Tree Creek just west of Jack Tone Road. Unlike most of the SJCDWQC area, rice is a major crop in the site subwatershed. Agriculture in the site subwatershed also consists of deciduous orchards, field crops and grains.

Monitoring and Analysis

Table 6 specifies the constituent groups monitored at each site subwatershed. The Coalition monitoring program consists of a mix of Phase I and Phase II monitoring elements at various sites. Phase II sites sample for all constituent groups and include all sites that have been monitored for at least 2 years. As a result, the sites added to the Coalition monitoring program in May 2006 (e.g. Mormon Slough @ Jack Tone Road, Duck Creek @ Hwy 4, Roberts Island Drain @ Holt Ave, Roberts Island Drain along House Rd, and Unnamed Drain to Lonetree Creek @ Jack Tone Rd) do not require sampling for metals or nutrients as outlined in the CVRWQCB's MRP (Table 1 of MRP). The Coalition is monitoring all Phase II pesticides at Phase I and Phase II sites. Refer to the sample details provided under Monitoring Results for a list of samples collected and constituents analyzed during each monitoring event of the storm season.

Because two years of sampling resulted in no exceedances of *E. coli* at the Mokelumne River @ Bruella Road site, the constituent was dropped from the suite of analytes monitored at that site after the storm season of 2006. However, since that time the CVRWQCB has requested that this constituent be added back into the Coalition monitoring schedule until the Monitoring and Reporting Program Plan has been approved by the Executive Officer. As a result, *E. coli* monitoring at the Mokelumne River site has been reinstituted with the onset of the 2008 irrigation season.

On November 19, 2007 the Coalition submitted a proposal to the Regional Board to drop constituents at sites that had been monitored for two or more full years which did not have a single exceedance of a water quality trigger limit. On December 14, 2007 the Coalition was notified by the Executive Officer that the Coalition would no longer need to monitor at the listed locations for the following constituents:

- Marsh Creek @ Concord Ave: organophosphates, pyrethroids, *Ceriodaphnia dubia* toxicity, and *Selenastrum capricornutum* toxicity,
- Mokelumne River @ Bruella Rd: pyrethroids, *Pimephales promelas* toxicity,
- Terminous Tract @ Hwy 12: pyrethroids and *Hyallela azteca* toxicity.

Table 6. SJCDWQC storm 2008 sampling constituents.

Constituents listed below include field parameters (pH, DO, EC and temperature), metals, nutrients, physical parameters (color, turbidity, total dissolved solids), total organic carbon (TOC), *E. coli*, pesticides (organophosphates, pyrethroids, carbamates, herbicides, organochlorines, and glyphosate/paraquat), water column toxicity (water flea, algae and fathead minnow) and sediment toxicity.

Site Name	Field Parameters	Metals	Nutrients	TOC	Physical Parameters	*E. coli*	Organophosphates	Pyrethroids	Carbamates	Herbicides	Organochlorines	Glyphosate and Paraquat	Water flee toxicity	Algae toxicity	Fathead minnow toxicity	Sediment Toxicity
Duck Creek @ Hwy 4	x			x	x	x	x	x	x	x	x	x	x	x	x	x
French Camp Slough @ Airport Way†	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Grant Line Canal near Calpack Rd†	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Grant Line Canal @ Clifton Court Rd†	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Kellogg Creek along Hoffman Ln†	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Littlejohns Creek @ Jack Tone Rd†	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Lone Tree Creek @ Jack Tone Rd†	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Marsh Creek @ Concord Ave†	x	x	x	x	x	x			x	x	x	x			x	x
Mokelumne River @ Bruella Rd†	x	x	x	x	x		x		x	x	x	x	x	x		x
Mormon Slough @ Jack Tone Rd	x			x	x	x	x	x	x	x	x	x	x	x	x	x
Roberts Island Drain @ Holt Rd	x			x	x	x	x	x	x	x	x	x	x	x	x	x
Roberts Island Drain along House Rd	x			x	x	x	x	x	x	x	x	x	x	x	x	x
Sand Creek @ Hwy 4 Bypass	x			x	x	x	x	x	x	x	x	x	x	x	x	x
Terminous Tract Drain @ Hwy 12†	x	x	x	x	x	x	x		x	x	x	x	x	x	x	
Unnamed Drain to Lone Tree Cr @ Jack Tone Rd	x			x	x	x	x	x	x	x	x	x	x	x	x	x

† indicates sites that have been monitored for at least two years.

Location Maps of Sample Sites and Land Use

All site subwatersheds in Table 7 drain agricultural land in the Coalition region. The table below includes the land use acreage for each major crop or land use type and designated as irrigated/non-irrigated (I/NI). Land use for each site subwatershed is provided and is listed by alphabetical order. Land use maps are provided as Figures 8-11 (a legend for land use is provided in Figure 12) and includes parcel specific land use data well as the hydrology that drains those parcels. Not included are roadside ditches that may drain fields to the nearest surface water body. Ditches are constructed to move water draining from roads adjacent to the fields and are not generally constructed to move water draining from agricultural fields. A narrative description of each site subwatershed monitored during the 2008 storm season is provided in the previous section, Sampling Sites Descriptions.

Table 7. Land use acreage of site subwatersheds.

Land Use	I/NI	Duck Creek @ Hwy 4	French Camp Slough @ Airport Way	Grant Line Canal near Calpack Rd	Grant Line Canal @ Clifton Ct	Kellogg Creek along Hoffman Ln	Littlejohns Creek @ Jack Tone Rd.	Lone Tree Creek @ Jack Tone Rd.	Marsh Creek @ Concord	Marsh Creek @ Marsh Creek Rd Lower	Marsh Creek @ Marsh Creek Rd Upper	Mokelumne River @ Bruella Rd	Mormon Slough @ Jack Tone Rd	Roberts Is Drain @ Holt Rd	Roberts Is Drain along House Rd	Sand Creek @ Hwy 4 Bypass	Terminous Tract @ Hwy 12	Unnamed Drain to Lone Creek @ Jack Tone Rd
Citrus	I	1,618.6	11.4			4.0		11.4				5.1	6.2					
Deciduous Nut And Fruit	I	1,927.7	10,301.9			846.7	2,391.7	4,641.4	122.6	22.4	22.4	2,590.2	9,333.6			108.9		919.9
Deciduous Nut And Fruit	NI								21.4	21.4	21.4	4.3						
Field Crop	I	3,483.8	7,368.8	873.4	443.1	218.4	1,246.7	1,832.5	20.8			518.4	1,308.5	927.5	795.5		5,100.9	3,136.5
Grain And Hay	I		14,977.8	49.1	313.1		3,314.8	4,843.2	69.7	69.7	69.7	98.3	2,047.3	604.9	77.5	76.5	2,056.8	5,089.7
Grain And Hay	NI		332.9				326.8	22.7	135.8	135.8			14.9					
Idle	I	64.6	607.7			122.6	109.0	202.2	16.9	73.4	16.9	480.4	425.1				37.1	289.0
Idle	NI								56.5		56.5							
Barren Wasteland	NI											11.4						
Raparian Vegetation	NI		16.3					6.5	39.4	10.8		258.6	35.9	1.1			50.7	9.8
Wild Vegetation	NI	91.3	1,430.1				226.4	144.6	60.2	60.2	60.2	1,695.2	694.9	14.6	286.2		310.5	264.0
Water Surface	NI	11.6	81.2				16.9	4.2	48.2	48.2	2.9	443.0	155.6		10.6			20.5
Pasture	I	1,080.7	15,233.9	721.8		52.5	1,392.3	6,352.3				892.1	1,461.9	91.9	587.8		1,067.3	5,625.7
Pasture	NI												20.9					
Rice	I		5,973.5					3,000.7										2,933.3
Feedlot, Dairy, Farmstead	NI	112.5	2,233.4	14.8		30.3	210.5	932.3	29.8	29.1	26.2	147.5	232.8	10.5	12.7		19.4	972.5
Truck, Nursery, Berry	I	1,551.3	,811.2	32.1		872.3	1,267.4	297.3				324.7	2952.	360.1	80.2		1,275.6	1,415.2
Urban	NI	101.1	1,576.1			10.1	292.2	429.4	944.3	944.3	834.1	520.7	498.1	24.0	9.7		143.7	182.3
Golfcourse, Cemetery, Landscape	NI	18.0	165.4				8.7	29.4										
Vineyard	I	1,050.2	8,215.7				2,633.7	1,177.6				6,351.5	3,683.7				350.6	3,641.5
Vineyard	NI																	
Total Acres		**11,111.4**	**74,337.2**	**1,691.1**	**756.2**	**2,156.9**	**13,437.1**	**23,927.7**	**1,565.6**	**1,415.3**	**1,110.4**	**14,321.5**	**22,872.0**	**2,034.6**	**1,860.6**	**185.4**	**10,413.0**	**24,500.5**
Irrigated Acres		**10,776.9**	**68,501.9**	**1,676.3**	**756.2**	**2,116.4**	**12,355.6**	**22,358.6**	**229.9**	**165.6**	**109.0**	**8,670.5**	**21,218.6**	**1,984.5**	**1,541.2**	**185.4**	**9,888.5**	**23,051.2**

* Land use information was obtained from data provided by California Department of Water Resources, http://www.landwateruse.water.ca.gov/annualdata/landuse/2001/landuselevels.cfm. Data was compiled in 2001 and land use in some parts of the SJCDWQC area may have changed since that time.

Figure 8. Coalition map showing land use in all site subwatersheds identified for sampling in 2008 storm season.

A legend is provided in Figure 12.

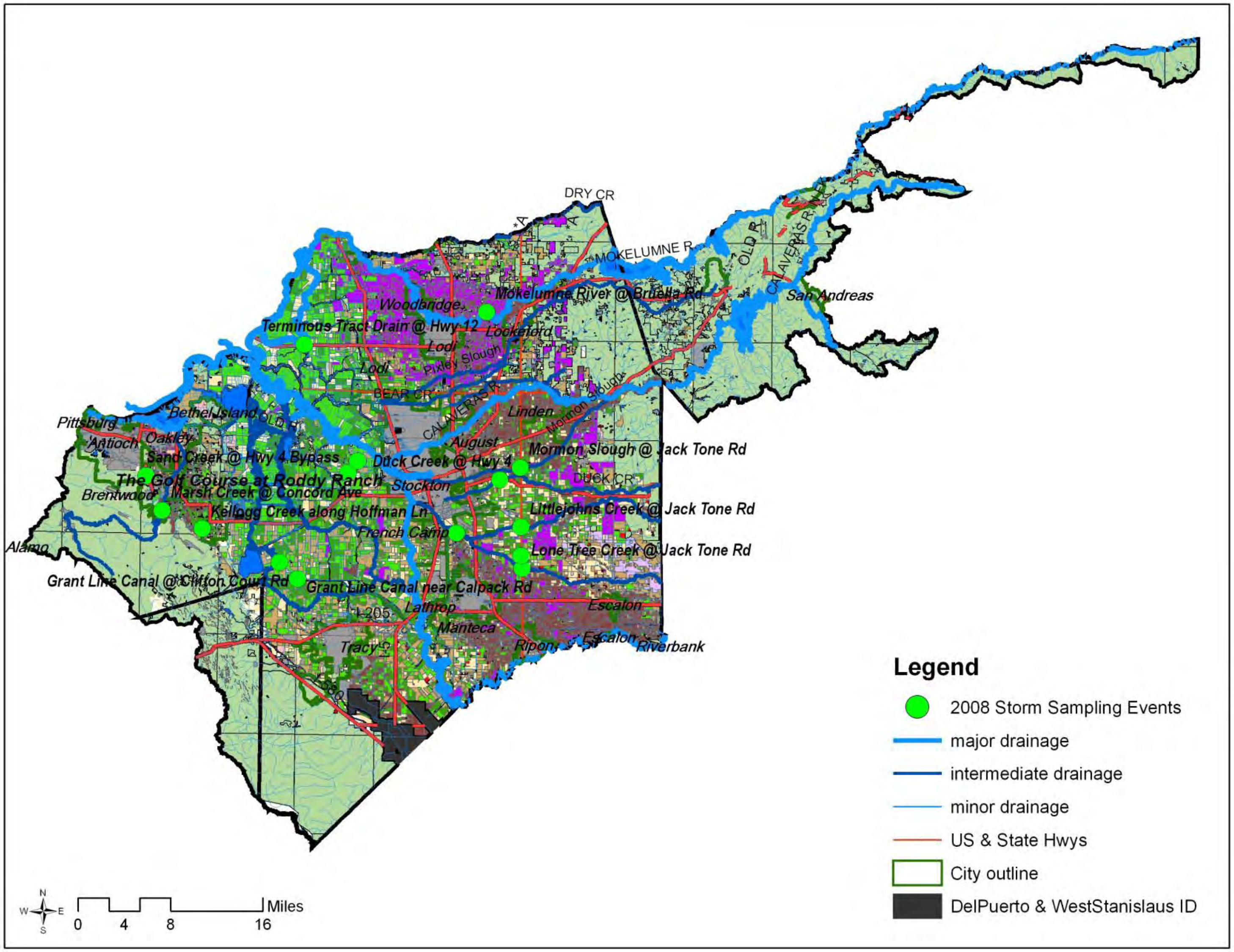


Figure 9. Land use for monitoring sites in Contra Costa County.

A legend is provided in Figure 12.

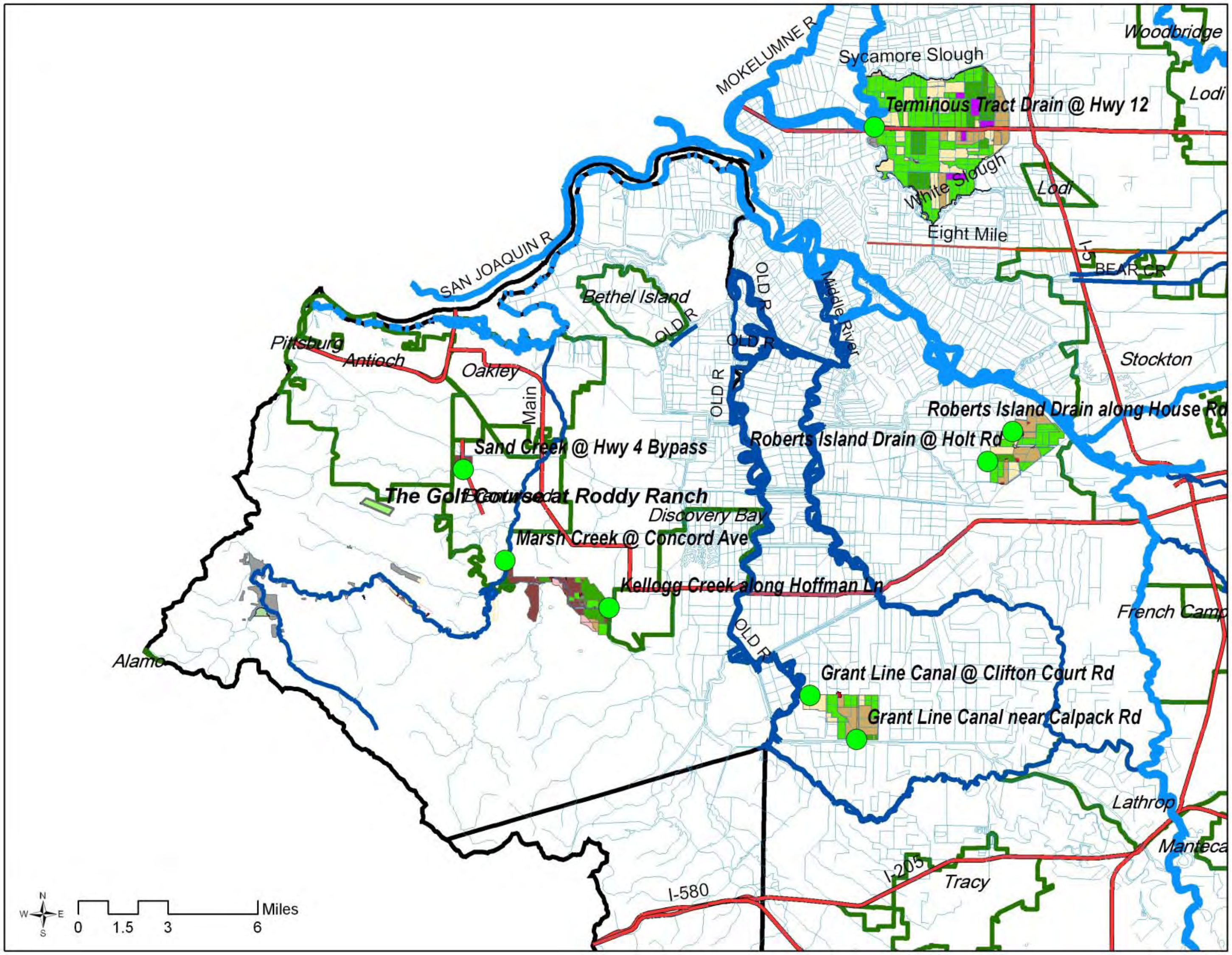


Figure 10. Land use for monitoring sites in north San Joaquin County.

A legend is provided in Figure 12.

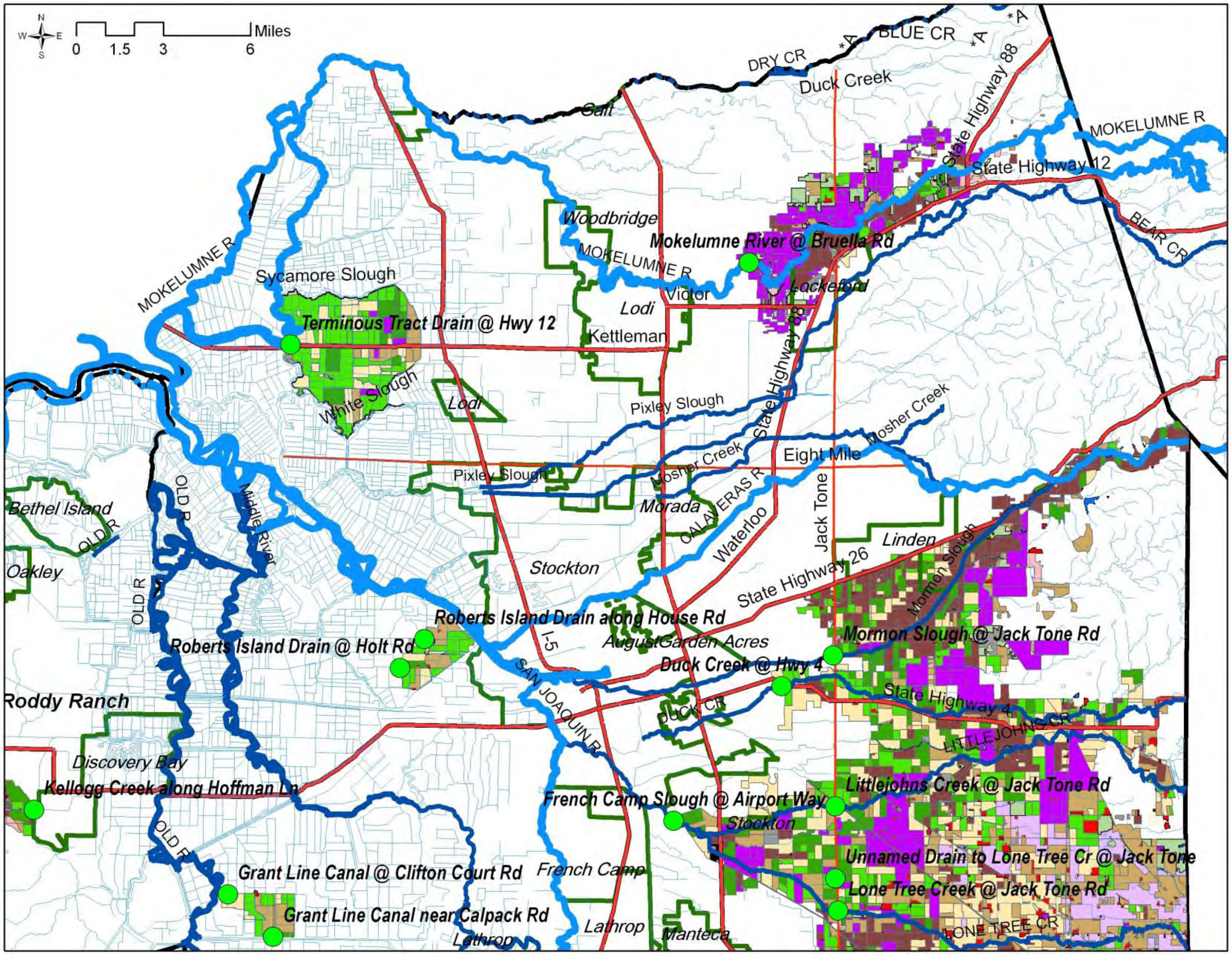


Figure 11. Land use for monitoring sites in south San Joaquin County.

A legend is provided in Figure 12.

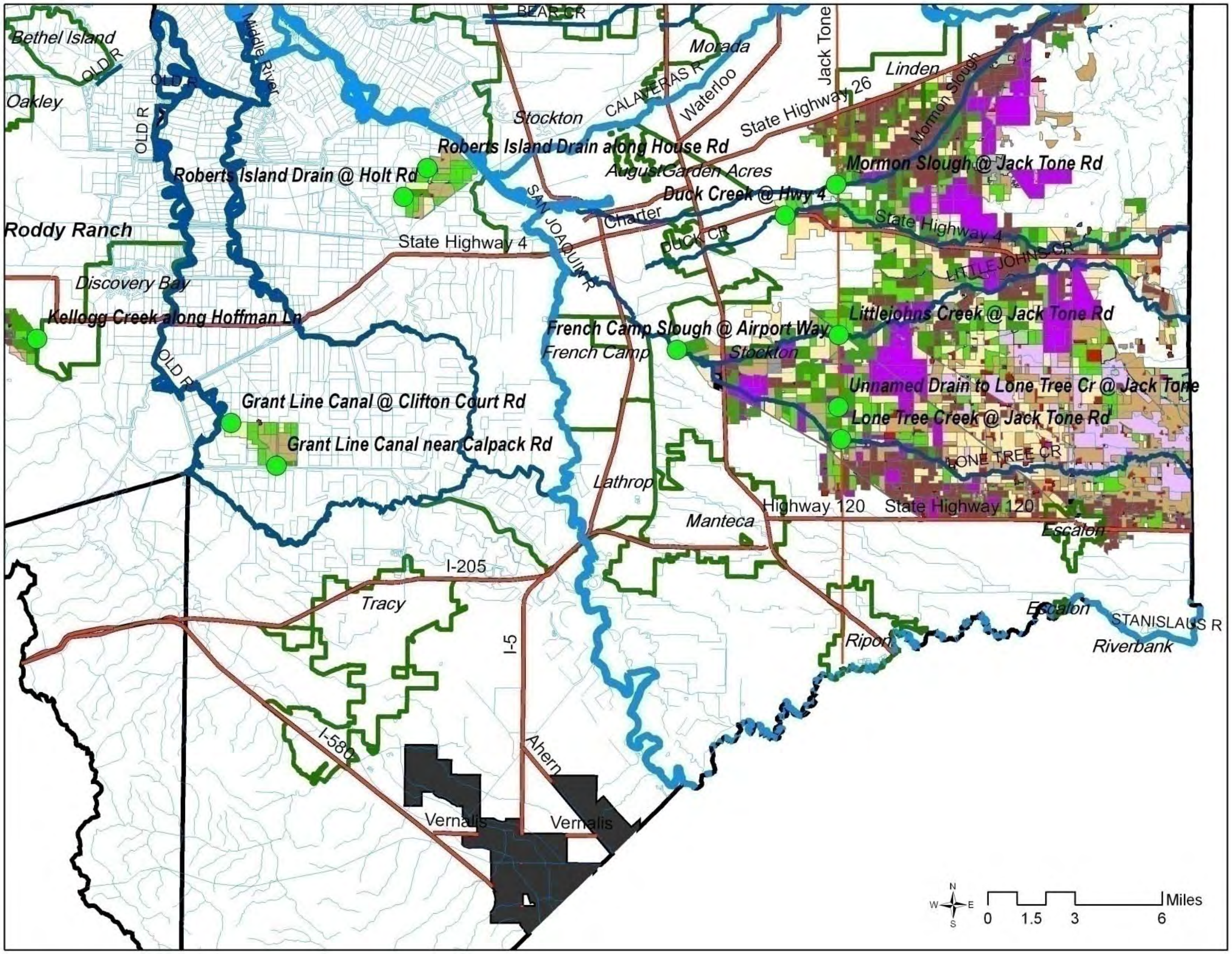


Figure 12. Legend for land use data.

Monitoring Results

Sample Details

Monitoring results from the 2008 storm season are included in Appendix I. The results include field parameters, organics, inorganics including metals and *E. coli*, toxicity and loads calculated for any detected analyte with corresponding site flow. Loads have been calculated for all detections (Table I-6) according to the following formula:

Instantaneous Load (µg/sec) = Discharge (cfs) X 28.317L x Concentration (milligram/L x 1,000 or µg/L).

The load values calculated and presented for pesticides or other constitutents in this report represent instantaneous loads only. These values should not be used to extrapolate loading over any period of time (e.g. weekly, monthly, seasonal or annual). The primary purpose for reporting instantaneous loads is to provide the Regional Water Board with a context for the concentrations of various constituents at the time that samples were collected.

Monitoring results include results from samples taken for normal monitoring and sediment toxicity monitoring including resampling due to toxicity. Each sampling location, sampling date, sampling time and type of monitoring is listed in Table 8.

Table 8. Sample details for the 2008 storm season sorted by station name, sample date and monitoring event.

NM = Normal Monitoring (water column) including resampling due to toxicity. Sediment = Sediment sampling including resampling due to toxicity. Sediment is not sampled for at Terminous Tract @ Hwy 12.

Station Name	Station Code	Monitoring Event	Season	Sample Date	Sample Time	Failure Reason	Sample Comments
Duck Creek @ Hwy 4	531XDCAHF	NM	Storm1	23/Jan/2008	13:06	none	
Duck Creek @ Hwy 4	531XDCAHF	Sediment	Storm2	18/Mar/2008	9:00	Other	Sediment not submitted for analysis due to non-contiguous water.
French Camp Slough @ Airport Way	531SJC504	NM	Storm1	23/Jan/2008	17:00	none	
French Camp Slough @ Airport Way	531SJC504	Sediment	Storm2	18/Mar/2008	11:20	none	
French Camp Slough @ Airport Way	531SJC504	Sediment	Storm2	09/Apr/2008	10:50	none	Resampling event due to *Hyalella* toxicity on 03/18/08.
Grant Line Canal @ Clifton Court Rd	544XGLCAA	NM	Storm1	23/Jan/2008	15:10	none	
Grant Line Canal @ Clifton Court Rd	544XGLCAA	NM	Storm1	30/Jan/2008	9:00	none	Resampling event due to *Selenastrum* and *Ceriodaphnia* toxicity on 01/23/08.
Grant Line Canal @ Clifton Court Rd	544XGLCAA	Sediment	Storm2	18/Mar/2008	10:20	none	
Grant Line Canal near Calpack Rd	544XGLCCR	NM	Storm1	23/Jan/2008	13:40	none	
Grant Line Canal near Calpack Rd	544XGLCCR	NM	Storm1	30/Jan/2008	9:30	none	Resampling event due to *Selenastrum* toxicity on 01/23/08.
Grant Line Canal near Calpack Rd	544XGLCCR	Sediment	Storm2	18/Mar/2008	10:50	none	
Kellogg Creek along Hoffman Ln	544XKCAHL	NM	Storm1	23/Jan/2008	13:10	Dry	
Kellogg Creek along Hoffman Ln	544XKCAHL	Sediment	Storm2	18/Mar/2008	12:20	none	
Kellogg Creek along Hoffman Ln	544XKCAHL	Sediment	Storm2	09/Apr/2008	9:50	none	Resampling event due to *Hyalella* toxicity on 03/18/08.
Littlejohns Creek @ Jack Tone Rd	531XLCAJR	NM	Storm1	23/Jan/2008	14:30	none	
Littlejohns Creek @ Jack Tone Rd	531XLCAJR	Sediment	Storm2	18/Mar/2008	9:40	none	
Lone Tree Creek @ Jack Tone Rd	531XLTCJR	NM	Storm1	23/Jan/2008	17:10	none	

Station Name	Station Code	Monitoring Event	Season	Sample Date	Sample Time	Failure Reason	Sample Comments
Lone Tree Creek @ Jack Tone Rd	531XLTCJR	NM	Storm1	30/Jan/2008	10:30	none	Resampling event due to *Pimephales*, *Ceriodaphnia*, and *Selenastrum* toxicity on 01/23/2008.
Lone Tree Creek @ Jack Tone Rd	531XLTCJR	Sediment	Storm2	18/Mar/2008	10:30	none	
Marsh Creek @ Concord Ave	544XMCACA	NM	Storm1	23/Jan/2008	11:50	none	
Marsh Creek @ Concord Ave	544XMCACA	Sediment	Storm2	18/Mar/2008	13:00	none	
Marsh Creek @ Concord Ave	544XMCACA	Sediment	Storm2	09/Apr/2008	9:20	none	Resampling event due to *Hyalella* toxicity on 03/18/08.
Mokelumne River @ Bruella Rd	531XMRABR	NM	Storm1	23/Jan/2008	10:30	none	
Mokelumne River @ Bruella Rd	531XMRABR	Sediment	Storm2	18/Mar/2008	7:40	none	
Mormon Slough @ Jack Tone Rd	544MSAJTR	NM	Storm1	23/Jan/2008	12:00	none	
Mormon Slough @ Jack Tone Rd	544MSAJTR	Sediment	Storm2	18/Mar/2008	8:30	none	
Roberts Island Drain @ Holt Rd	544RIDAHT	NM	Storm1	23/Jan/2008	9:10	none	
Roberts Island Drain @ Holt Rd	544RIDAHT	NM	Storm1	30/Jan/2008	8:30	none	Resampling event due to *Selenastrum* toxicity on 01/23/2008.
Roberts Island Drain @ Holt Rd	544RIDAHT	Sediment	Storm2	18/Mar/2008	9:40	none	
Roberts Island Drain along House Rd	544RIDAHR	NM	Storm1	23/Jan/2008	8:10	none	
Roberts Island Drain along House Rd	544RIDAHR	Sediment	Storm2	18/Mar/2008	9:20	none	
Sand Creek @ Hwy 4 Bypass	544SCAHFB	NM	Storm1	23/Jan/2008	10:40	none	
Sand Creek @ Hwy 4 Bypass	544SCAHFB	Sediment	Storm2	18/Mar/2008	13:30	none	
Sand Creek @ Hwy 4 Bypass	544SCAHFB	Sediment	Storm2	09/Apr/2008	8:50	none	Resampling event due to *Hyalella* toxicity on 03/18/08.
Terminous Tract Drain @ Hwy 12	544XTTHWT	NM	Storm1	23/Jan/2008	7:50	none	
Terminous Tract Drain @ Hwy 12	544XTTHWT	NM	Storm1	30/Jan/2008	7:30	none	Resampling event due to *Selenastrum* toxicity on 01/23/2008.
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	531UDLTAJ	NM	Storm1	23/Jan/2008	15:40	none	

Station Name	Station Code	Monitoring Event	Season	Sample Date	Sample Time	Failure Reason	Sample Comments
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	531UDLTAJ	NM	Storm1	30/Jan/2008	11:00	none	Resampling event due to *Ceriodaphnia* toxicity on 01/23/2008.
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	531UDLTAJ	Sediment	Storm2	18/Mar/2008	10:10	none	
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	531UDLTAJ	Sediment	Storm2	09/Apr/2008	11:20	none	Resampling event due to *Hyalella* toxicity on 03/18/08.

Sampling and Analytical Methods Used

Sample collection criteria and field instruments are provided in Table 9 and Table 10. Analytical methods and reporting limits are provided in Table 11. All field sampling methods were performed as outlined in the SOPs provided in the Quality Assurance Project Plan (QAPP). All analytical methods were performed as described in the QAPP.

Table 9. Sampling procedures, containers, sample volumes, preservation and storage techniques and holding times.

Parameter	Sample Container	Sample Volume[1]	Immediate Processing and Storage	Holding Time[2]
Physical Parameters[3]				
Color	Glass or polyethylene	500 mL	Store at 4°C	48 hours
Turbidity	Glass or polyethylene	150 mL	Store at 4°C	48 hours
Total Dissolved Solids	Polyethylene	500 mL	Store at 4°C	7 days
Drinking Water				
E. coli (pathogens)	Polyethylene (sterile)	100 mL	Store at 4°C	24 hours[4]
Total Organic Carbon	Amber Glass VOA, PTFE-lined cap	125 mL	Preserve w/HCL; Store at 4°C	28 days
Toxicity				
Aquatic bioassays	Amber glass	5 gallons	Store at 4°C	36 hours
Sediment bioassays	Glass	1 liter (x2)	Store at 4°C	14 days
Pesticides				
Carbamates	Amber Glass	1 liter	Store at 4°C; Extract within 7 days	40 days
Organochlorines	Amber Glass	1 liter		
Organophosphates	Amber Glass	1 liter		
Pyrethroids	Amber Glass	1 liter		
Herbicides (general)	Amber Glass	1 liter		
Herbicides (paraquat)	Polyethylene	1 liter		
Herbicides (glyphosate)	Amber Glass VOA	40 ml (x2)	Store at 4°C, freeze within 2 weeks	6 months
Nutrients				
TKN, Ammonia, and Total Phosphorus	Polyethylene	500 mL	Preserve to $\leq$ pH 2 with H_2SO_4; Store at 4°C	28 days
Nitrate as NO3, Nitrite as N, and Soluble Ortho-Phosphate	Polyethylene	1000 mL	Store at 4°C	48 hours
Metals/Trace Elements				
Trace elements[5]	Polyethylene	500 mL	Filter as necessary; Preserve to $\leq$ pH 2 with HNO_3	40 days

1. Additional volumes may be required for QC analyses; NA = Not Applicable
2. Holding time after initial preservation or extraction.
3. Volume of water necessary to analyze the physical parameters is typically combined in multiple 1L polyethylene bottles, which provides sufficient volume for re-analyses and lab spike duplicates. This is only possible when the same laboratory provides the analyses for all of the physical parameters.
4. Samples for bacteria analyses should be set up as soon as possible.
5. To include arsenic, boron, cadmium, copper, lead, nickel, selenium, and zinc.

Table 10. Field parameters and instruments used to collect measurements.

Parameter	Instrument
Dissolved Oxygen	YSI Model 556
Temperature	YSI Model 556
pH	YSI Model 556
Electrical Conductivity	YSI Model 556
Discharge	Marsh-McBirney Flow Meter

Table 11. Analytical methods, target reporting limits (RL) and units.

Analyte	Method	RL	Units
Physical Parameters			
Color	EPA 100.2	5.0	color units
Turbidity	EPA 180.1	1.0	NTU
Dissolved Solids, Total	EPA 160.1	10	mg/L
Drinking Water Parameters			
Escherischia coli (*E. coli*)	SM 9223	2	MPN/100 mL
Total Organic Carbon	EPA 415.1	0.5	mg/L
Nutrients			
Total Kjeldahl Nitrogen	EPA 351.3	0.5	mg/L
Nitrate as NO_3	EPA 300.0	0.05	mg/L
Nitrite as Nitrogen	EPA 354.1	0.05	mg/L
Ammonia	EPA 350.2	0.10	mg/L
Hardness	EPA 130.2	10	mg/L
Total Phosphorus	EPA 365.2	0.01	mg/L
Soluble Orthophosphate	EPA 365.2	0.01	mg/L
Metals			
Arsenic	EPA 200.8	1	µg/L
Boron	EPA 200.8	10	µg/L
Cadmium	EPA 200.8	0.1	µg/L
Copper	EPA 200.8	0.5	µg/L
Lead	EPA 200.8	0.5	µg/L
Nickel	EPA 200.8	1	µg/L
Selenium	EPA 200.8	1	µg/L
Zinc	EPA 200.8	1	µg/L
Carbamate Pesticides			
Aldicarb	EPA 8321	0.5	µg/L
Carbaryl	EPA 8321	0.5	µg/L
Carbofuran	EPA 8321	0.5	µg/L
Methiocarb	EPA 8321	0.5	µg/L
Methomyl	EPA 8321	0.5	µg/L
Oxnamyl	EPA 8321	0.5	µg/L
Organochlorine Pesticides			
DDD	EPA 8081A	0.02	µg/L
DDE	EPA 8081A	0.01	µg/L
DDT	EPA 8081A	0.01	µg/L
Dicofol	EPA 8081A	0.1	µg/L
Dieldrin	EPA 8081A	0.01	µg/L
Endrin	EPA 8081A	0.01	µg/L
Methoxychlor	EPA 8081A	0.05	µg/L

Analyte	Method	RL	Units
Organophosphorus Pesticides			
Azinphos-methyl	EPA 8141A	0.1	µg/L
Chlorpyrifos	EPA 8141A	0.02	µg/L
Diazinon	EPA 8141A	0.02	µg/L
Dimethoate	EPA 8141A	0.1	µg/L
Disulfoton	EPA 8141A	0.1	µg/L
Malathion	EPA 8141A	0.1	µg/L
Methamidophos	EPA 8141A	0.2	µg/L
Methidathion	EPA 8141A	0.1	µg/L
Parathion-methyl	EPA 8141A	0.1	µg/L
Phorate	EPA 8141A	0.2	µg/L
Phosmet	EPA 8141A	0.2	µg/L
Pyrethroid Pesticides			
Biphenthrin	EPA 8081A	0.05	µg/L
Cyfluthrin	EPA 8081A	0.05	µg/L
Cypermethrin	EPA 8081A	0.05	µg/L
Esfenvalerate	EPA 8081A	0.05	µg/L
Lambda-Cyhalothrin	EPA 8081A	0.05	µg/L
Permethrin	EPA 8081A	0.05	µg/L
Herbicides			
Atrazine	EPA 619	0.5	µg/L
Cyanazine	EPA 619	0.5	µg/L
Diuron	EPA 8321	0.5	µg/L
Glyphosate	EPA 547	5	µg/L
Linuron	EPA 8321	0.5	µg/L
Molinate	EPA 8141A	0.5	µg/L
Paraquat dichloride	EPA 549.2	0.5	µg/L
Simazine	EPA 619	0.5	µg/L
Thiobencarb	EPA 8141A	0.5	µg/L

Copy of Chain of Custody Forms

Original chain of custodies (COCs) were scanned into documents and are included as printed pdfs (Appendix II). COCs were faxed by the laboratories to Michael L Johnson, LLC (MLJ-LLC) after the receipt of samples by the laboratory. As such, they are complete and accurate records of sample handling and processing and reflect the timing of sample collection and delivery to the laboratories. Sample collection and delivery was performed according to the QAPP submitted to the Regional Board. If there were any discrepancies between the COC and sample delivery, the issues were resolved and documented either directly on the COC or on an anomaly form filled out by the laboratory. Documentation of COC anomalies is included in Table II-1 of Appendix II.

Lab and Field QC Results

Laboratory and field quality control (QC) results are included in Appendix III. Field duplicate and field blank results are included for organics, inorganics (including metals, physical parameters, nutrients and *E. coli*) and toxicity (only field duplicates). Laboratory QC results include matrix spikes (MS) performed on both Coalition and samples from other projects, laboratory control spikes (LCS), laboratory blanks and laboratory duplicates. All control criteria are listed with the result and samples not meeting control criteria are flagged.

Precision and Accuracy

Normal surface water monitoring occurred one time during the storm season of 2008 for 15 sites with the following exception due to lack of water:

- Kellogg Creek @ Hoffman Ln (01/23/08)

Resampling to test for water column toxicity persistence occurred at the following sites:

- Grant Line Canal @ Clifton Court Rd (01/30/08)
- Grant Line near Calpack Rd (01/30/08)
- Lonetree Creek @ Jack Tone Rd (01/30/08)
- Roberts Island Drain @ Holt Rd (01/30/08)
- Terminous Tract Drain @ Hwy 12 (01/30/08)
- Unnamed Drain to Lone Tree Creek @ Jack Tone Rd (01/30/08)

Sediment sampling occurred once during the storm season during the month of March. The sediment from the following site was not submitted due to non-contiguous water:

- Duck Creek @ Hwy 4 (03/18/08)

Resampling to test for sediment toxicity persistence occurred at the following sites:

- French Camp Slough @ Airport Way (04/09/08)
- Kellogg Creek along Hoffman Ln (04/09/08)
- Marsh Creek @ Concord Ave (04/09/08)
- Sand Creek @ Hwy 4 Bypass (04/09/08)
- Unnamed Drain to Lone Tree Creek @ Jack Tone Rd (04/09/08)

During the irrigation season, 10 sites were sampled in addition to normal monitoring for management plan monitoring, either upstream of the normal monitoring site or in addition to normal monitoring (see site subwatershed management plans for details). Management plan sampling occurred 34 times over the 10 sites with zero exceptions due to a lack of water.

Chemistry

Due to the addition of new sites during the irrigation season of 2006, not all sites are sampled for all constituents since they are part of Phase I monitoring. In addition some constituents at specific sites have been dropped due to no exceedances in two or more years (see Table 6). Therefore, for normal monitoring, not including laboratory or field QCs, 14 organic pesticide (carbamates, organochlorine, and herbicides), 13 organophosphate pesticide, 11 pyrethroid, 14 *E. coli* and physical parameter, and 8 nutrient and metal samples were collected and analyzed for the storm event in 2008. There was 100% completeness for environmental samples collected for chemistry analyses.

For each storm event, one field duplicate and field blank were collected for each constituent to meet the field QC requirement of 5%. Since only one storm event was sampled, field QCs were greater than 5%. Field blanks and duplicates comprised 7-8% of organic samples, 7% of *E. coli* samples, 7% of physical parameter samples, and 12% of nutrient samples and metal samples.

For some constituents the environmental sample may exceed the amount that the detector can detect and therefore requires a dilution. The result reported is the amount found in the diluted sample multiplied by the dilution factor to represent the amount of the analyte present in the original sample. The dilution factor is recorded and the RL is generally increased by multiplying the RL for that analyte by the dilution factor. There are times that the RL is increased higher than this value based on method requirements. Therefore, for each dilution that occurs, there is a corresponding increase in the limit of quantification.

For pesticides such as paraquat, co-elution, also referred to as matrix interference, may cause the RL to be raised and the sample is flagged. In such cases the dilution factor (DF) is recorded in the laboratory comments for each sample.

All results are reported in the Monitoring Results section of this report (Appendix I). Each result is flagged if it does not meet data quality objectives (acceptability criteria) using SWAMP codes and can also be found in the SWAMP comparable database managed by the Coalition which is posted on the UC Davis Center for Environmental Data Exchange Network (CEDEN) ftp site (ftp://aeal-FTP.ucdavis.edu). A review of the number of samples analyzed and the percentage per analyte that meets acceptability criteria are listed in the tables following this section. A brief overview is listed below to assess overall precision and accuracy per analyte (all pesticides are grouped and discussed together).

- Color: One hundred percent of all field blanks and field duplicates met acceptability criteria. Laboratory control spikes and lab blanks were run with each color batch and all met laboratory QC criteria.

- Hardness: One hundred percent of field blanks were less than the RL and 100% of field duplicates had RPDs less than 25. Lab control spikes, matrix spikes, matrix spike duplicates, and lab blanks were run with every batch and all met precision and accuracy requirements.

- Total Dissolved Solids (TDS): One hundred percent of field blanks and field duplicates met acceptance criteria. Lab blanks were run with every batch and were less than the RL for 100% of samples. Laboratory control spikes and laboratory duplicates were analyzed with each batch and 100% met acceptance criteria. Matrix spikes cannot be performed for TDS.

- Turbidity: One hundred percent of field blanks met acceptance criteria. One hundred percent of field duplicates had RPDs less than 25. Lab blanks were run with every batch and were less than the RL. Laboratory duplicates were analyzed with each batch and 100% met acceptance criteria. Lab control spikes were run with every batch and met acceptability criteria for 100% of samples. Matrix spikes cannot be performed for turbidity.

- Nitrate as N: One hundred percent of field duplicates and field blanks met acceptance criteria. Lab blanks were run with every batch and were less than the RL for all samples. Laboratory control spikes were within acceptability criteria for all batches. Matrix spikes and matrix spike duplicates were performed in each batch. Fifty percent of matrix spikes and 100% of matrix spike duplicates met acceptability requirements for accuracy and precision.

- Ammonia as N: One hundred percent of field blanks met acceptance criteria. The single field duplicate sample collected did not meet the acceptance criteria, RPD less than 25. Lab blanks were run with every batch and were less than the RL. Lab control spikes, matrix spikes and matrix spike duplicates were within acceptability criteria for all batches meeting requirements of accuracy and precision.

- Nitrogen, Total Kjeldahl (TKN): One hundred percent of field blanks and field duplicates met acceptance criteria. Lab blanks were run with every batch and were less than the RL. Lab control spikes were within acceptability criteria for all batches. Matrix spikes and matrix spike duplicates were performed in each batch with 100% meeting acceptability requirements.

- Nitrite as N: One hundred percent of field duplicates and field blanks met acceptance criteria. Lab blanks were run with every batch and were less than the RL. Lab control spikes, matrix spikes and matrix spike duplicates were within acceptability criteria for all batches meeting requirements of accuracy and precision.

- Orthophosphate as P: One hundred percent of field and field blanks met acceptance criteria. Laboratory blanks were run with every batch and were less than the RL. The laboratory control spike was within acceptability criteria for the batch. Matrix spike samples met acceptability criteria for all the samples analyzed. One hundred percent of matrix spike duplicates were within acceptability criteria for precision.

- Phosphate as P: One hundred percent of field blanks and field duplicates met acceptance criteria. A single lab blank and laboratory control spike were run for the batch and met acceptance criteria. Matrix spike and matrix spike duplicate samples met acceptability criteria for 100% of the samples analyzed.

- Total Organic Carbon (TOC): One hundred percent of field duplicates and field blanks collected met acceptance criteria. A single laboratory blank was run with the batch and was less than the RL. The single lab control spike was within acceptability criteria. Matrix spikes and matrix spike duplicates were within acceptability criteria meeting requirements of accuracy and precision.

- Total Metals: One hundred percent of field blanks met field precision criteria except for the single zinc field blank sample. All field duplicates, except for selenium, met acceptance criteria. The single selenium field duplicate was not less than the reporting limit or one fifth of the environmental sample (environmental sample = 0.27 µg/L, field duplicate = 0.61 µg/L). Both of these results are below the reporting limit and are considered estimates. Due to the low concentrations of these samples that are below accurate reporting limits, the Coalition did not take any corrective measures. Due to past detections in field blanks, travel blanks were sent from the lab and traveled with the sampling crew from beginning to end. All travel blanks met acceptability criteria of being less than the RL. Laboratory blanks were run for each metals batch and 100% of samples met acceptability. Laboratory control spikes were within acceptable recovery limits for 100% of samples run. Matrix spike recoveries were within control limits for all samples except for boron and zinc. Fifty percent of the boron matrix spikes and 75% of the zinc matrix spikes were within control limits (PR 85-115). All matrix spike duplicates met acceptability criteria for precision (RPD < 25).

- *E. coli:* Sterility checks or laboratory blanks, negative control and positive control samples were run for each batch. One hundred percent of lab blanks performed by the laboratory were less than the RL. One hundred percent of field blanks collected had *E. coli* numbers less than the RL of 1. R_{log}s were performed on *E. coli* laboratory duplicates by Caltest Laboratories. The mean R_{log} for the laboratory was calculated to be 0.40. This value multiplied by 3.27 resulted in a precision criterion of 1.30. All laboratory duplicates had R_{log}s below the criteria acceptance level. Due to the nature of the analysis method and *E. coli* distribution within the water column, it is not possible to use RPDs to assess precision however field duplicate RPDs have been recorded to monitor the variation in duplicates over time analyzed by the lab. RPDs were also calculated for *E. coli* laboratory field duplicates and 100% were less than 25.

- Pesticides: One hundred percent of field duplicates except for simazine, chlorpyrifos and diazinon samples met acceptability criteria of RPDs <25 (RPDs were 27, 55 and 34, respectively). The field crews were notified of the high RPDs however all field SOPs were followed including collecting the environmental and field duplicate samples at the same time. Storm events tend to cause turbid waters due to increased sediment mobilization. A water body that is not well mixed across the width of the channel can result in unequal concentrations of a pesticide. The only pesticides that were detected in the field duplicate and the environmental sample were the three listed above and diuron. Out of these four pesticides, only diuron had an RPD that was less than 25 (RPD 1.3). One hundred percent of field blanks met acceptablility criteria except for simazine and chlorpyrifos. The detections in the field blank sample that exceeded the acceptance criteria (<RL or <1/5 the environmental sample) were 0.022 µg/L for chlorpyrifos (environmental sample = 0.045 µg/L) and 1.8 µg/L for simazine (environmental sample =

6.4 µg/L). Contamination in the field may be due to contamination of the field blank water, the field blank storage container, the field blank bottle, or contamination from the sampler. The water analyzed in the field blank was de-ionized water collected from UC Davis and stored in a high-density polyethylene (HDPE) carboy which is used only to store DI water. The field blank bottle came directly from the laboratory and is certified pre-clean. The bottle was not opened right before filling it with DI water. Clean gloves were used when filling the bottle with DI water from the carboy and neither the lid nor the opening of the bottle was touched. The cap was immediately returned to the bottle and screwed on tightly after filling with DI water. All sampling SOPs (which include the above steps to prevent contamination) were followed. Other sources of contamination may have occurred during transport from the field to the laboratory (all bottles were closed tightly and only touched when being put in the cooler by the sampler and taken from the cooler by the laboratory with gloved hands) and/or during the laboratory extraction process. The associated lab blank had no detections for any of the pesticides. It is difficult to know for sure the source of contamination and both the samplers and the laboratory have been informed of the issue.

For the storm season, pesticides were analyzed in eight different groups: pyrethroids (EPA 8081A), organochlorines (EPA 8081A), organophosphates (EPA 8141A), carbamates (EPA 8321A), methamidophos (EPA 8141A), paraquat (EPA 549.2), glyphosate (EPA 547), and triazines (EPA 619). Lab blanks were run with each batch and met acceptability criteria for all analysis. Matrix spikes and lab control spikes were performed for each batch to assess precision and accuracy as well as possible matrix interference. Either a matrix spike duplicate and/or a lab control spike duplicate were performed per batch to assess precision. Matrix spikes were within acceptability criteria for 85% of samples run. Laboratory precision assessed by the RPD of laboratory duplicates, met acceptability criteria in 100% of matrix spike duplicates. Laboratory control spikes and laboratory control spike duplicates were within acceptability criteria for 100% for all analytes. Surrogates were run for each analysis except for paraquat and glyphosate. Surrogate recoveries were within specific acceptance criteria for 95% of all samples analyzed. All batches with laboratory QCs outside of acceptability criteria have been flagged in addition to the specific sample acceptability criteria. When a surrogate is recovered outside of the acceptability criteria, the associated environmental sample is flagged as well. Batches are approved by evaluating all measures of precision and accuracy such that although a single QC sample may be outside of acceptability criteria, the entire batch may be accepted due to other QCs within that batch meeting acceptability criteria.

Hold times for all chemistry analysis were met.

Toxicity

For aquatic toxicity tests, the acceptability of test results is determined primarily by performance-based criteria for test organisms, culture and test conditions, and the results of control bioassays. Control bioassays include monthly reference toxicant testing and negative and solvent controls (for TIEs). Test acceptability requirements are documented in the method documents for each bioassay method and are included in the QAPP. In addition to the QA requirements for the toxicity testing methods, a minimum of 5% of the samples collected are required to be collected as field duplicates. Field duplicates were collected every sampling event such that the overall rate of field duplicates would be at least 5% of all samples including resamples due to toxicity during normal monitoring. The overall percentage of field duplicates are as follows: *Ceriodaphnia* 6%, *Pimephales* 7%, *Selenastrum* 5% and *Hyallela* 5%.

- Water Column Toxicity: Field duplicates were collected during the storm event and were tested for *Ceriodaphnia, Selenastrum, and Pimephales*. Field duplicates were within acceptability criteria (RPD < 25) for *Ceriodaphnia* and *Pimephales*. The *Selenastrum* field duplicates collected on January 23 had an RPD of 183 where one sample was toxic and the other was not. Therefore a resample was collected on January 30 as well as a second field duplicate. The field duplicate collected on January 30 had an RPD of 26.2 and neither sample was toxic. All tests met holding time requirements. Water quality values met EPA method guidelines for all samples except for dissolved oxygen from Lone Tree Creek @ Jack Tone Rd, and alkalinity and hardness values from site Roberts Island Drain along House Rd. The alkalinity and hardness values could not be measured from the Roberts Island Drain samples due to excessive sediment in the water samples. Control requirements (as listed in the EPA method guidelines) were met for all samples analyzed.

- Sediment Toxicity: Sediment was collected on March 18, 2008 and resampled on April 9, 2008. One field duplicate was collected and was within acceptability criteria. One hundred percent of the sediment samples had laboratory controls within acceptability criteria. All sediment samples met holding time criteria.

Table 12. SJCDWQC summary of field blank quality control sample evaluations.

Samples were collected during the storm season of 2008 and are sorted by method and analyte.

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8321A CARB	Aldicarb	<RL or < (env sample/5)	1	1	100.00
EPA 8321A CARB	Carbaryl	<RL or < (env sample/5)	1	1	100.00
EPA 8321A CARB	Carbofuran	<RL or < (env sample/5)	1	1	100.00
EPA 8321A CARB	Methiocarb	<RL or < (env sample/5)	1	1	100.00
EPA 8321A CARB	Methomyl	<RL or < (env sample/5)	1	1	100.00
EPA 8321A CARB	Oxamyl	<RL or < (env sample/5)	1	1	100.00
EPA 8321A CARB	Diuron	<RL or < (env sample/5)	1	1	100.00
EPA 8321A CARB	Linuron	<RL or < (env sample/5)	1	1	100.00
EPA 619	Atrazine	<RL or < (env sample/5)	1	1	100.00
EPA 619	Cyanazine	<RL or < (env sample/5)	1	1	100.00
EPA 619	Simazine	<RL or < (env sample/5)	1	0	0.00
EPA 547M	Glyphosate	<RL or < (env sample/5)	1	1	100.00
EPA 549.2M	Paraquat dichloride	<RL or < (env sample/5)	1	1	100.00
EPA 8081A	DDD(p,p')	<RL or < (env sample/5)	1	1	100.00
EPA 8081A	DDE(p,p')	<RL or < (env sample/5)	1	1	100.00
EPA 8081A	DDT(p,p')	<RL or < (env sample/5)	1	1	100.00
EPA 8081A	Dicofol	<RL or < (env sample/5)	1	1	100.00
EPA 8081A	Dieldrin	<RL or < (env sample/5)	1	1	100.00
EPA 8081A	Endrin	<RL or < (env sample/5)	1	1	100.00
EPA 8081A	Methoxychlor	<RL or < (env sample/5)	1	1	100.00
EPA 8081A	Bifenthrin	<RL or < (env sample/5)	1	1	100.00
EPA 8081A	Cyfluthrin, total	<RL or < (env sample/5)	1	1	100.00
EPA 8081A	Cypermethrin, total	<RL or < (env sample/5)	1	1	100.00
EPA 8081A	Esfenvalerate/Fenvalerate, total	<RL or < (env sample/5)	1	1	100.00
EPA 8081A	Cyhalothrin, lambda, total	<RL or < (env sample/5)	1	1	100.00
EPA 8081A	Permethrin, total	<RL or < (env sample/5)	1	1	100.00
EPA 8141A OP	Azinphos methyl	<RL or < (env sample/5)	1	1	100.00
EPA 8141A OP	Chlorpyrifos	<RL or < (env sample/5)	1	0	0.00
EPA 8141A OP	Diazinon	<RL or < (env sample/5)	1	0	0.00
EPA 8141A OP	Dimethoate	<RL or < (env sample/5)	1	1	100.00
EPA 8141A OP	Disulfoton	<RL or < (env sample/5)	1	1	100.00
EPA 8141A OP	Malathion	<RL or < (env sample/5)	1	1	100.00
EPA 8141A OP	Methidathion	<RL or < (env sample/5)	1	1	100.00
EPA 8141A OP	Parathion, Methyl	<RL or < (env sample/5)	1	1	100.00
EPA 8141A OP	Phorate	<RL or < (env sample/5)	1	1	100.00
EPA 8141A OP	Phosmet	<RL or < (env sample/5)	1	1	100.00
EPA 8141A OP	Molinate	<RL or < (env sample/5)	1	1	100.00

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8141A OP	Thiobencarb	<RL or < (env sample/5)	1	1	100.00
EPA 8141A OP	Methamidophos	<RL or < (env sample/5)	1	1	100.00
EPA 110.2	Color	<RL or < (env sample/5)	1	1	100.00
EPA 130.2	Hardness as CaCO3	<RL or < (env sample/5)	1	1	100.00
EPA 160.1	Total Dissolved Solids	<RL or < (env sample/5)	1	1	100.00
EPA 180.1	Turbidity	<RL or < (env sample/5)	1	1	100.00
EPA 300.0	Nitrate as N	<RL or < (env sample/5)	1	1	100.00
EPA 350.2	Ammonia as N	<RL or < (env sample/5)	1	1	100.00
EPA 351.3	Nitrogen, Total Kjeldahl	<RL or < (env sample/5)	1	1	100.00
EPA 354.1	Nitrite as N	<RL or < (env sample/5)	1	1	100.00
EPA 365.2	OrthoPhosphate as P	<RL or < (env sample/5)	1	1	100.00
EPA 365.2	Phosphate as P	<RL or < (env sample/5)	1	1	100.00
EPA 415.1	Total Organic Carbon	<RL or < (env sample/5)	1	1	100.00
SM 9223	E. coli	<RL or < (env sample/5)	1	1	100.00
EPA 200.8	Arsenic	<RL or < (env sample/5)	1	1	100.00
EPA 200.8	Boron	<RL or < (env sample/5)	1	1	100.00
EPA 200.8	Cadmium	<RL or < (env sample/5)	1	1	100.00
EPA 200.8	Copper	<RL or < (env sample/5)	1	1	100.00
EPA 200.8	Lead	<RL or < (env sample/5)	1	1	100.00
EPA 200.8	Nickel	<RL or < (env sample/5)	1	1	100.00
EPA 200.8	Selenium	<RL or < (env sample/5)	1	1	100.00
EPA 200.8	Zinc	<RL or < (env sample/5)	1	1	100.00
		TOTAL	59	56	94.92

Table 13. SJCDWQC summary of field duplicate quality control sample evaluations.

Samples were collected during the storm season of 2008 and are sorted by method and analyte.

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8321A CARB	Aldicarb	RPD ≤ 25	1	1	100.00
EPA 8321A CARB	Carbaryl	RPD ≤ 25	1	1	100.00
EPA 8321A CARB	Carbofuran	RPD ≤ 25	1	1	100.00
EPA 8321A CARB	Methiocarb	RPD ≤ 25	1	1	100.00
EPA 8321A CARB	Methomyl	RPD ≤ 25	1	1	100.00
EPA 8321A CARB	Oxamyl	RPD ≤ 25	1	1	100.00
EPA 8321A CARB	Diuron	RPD ≤ 25	1	1	100.00
EPA 8321A CARB	Linuron	RPD ≤ 25	1	1	100.00
EPA 619	Atrazine	RPD ≤ 25	1	1	100.00
EPA 619	Cyanazine	RPD ≤ 25	1	1	100.00
EPA 619	Simazine	RPD ≤ 25	1	0	0.00
EPA 547M	Glyphosate	RPD ≤ 25	1	1	100.00
EPA 549.2M	Paraquat dichloride	RPD ≤ 25	1	1	100.00
EPA 8081A	DDD(p,p')	RPD ≤ 25	1	1	100.00
EPA 8081A	DDE(p,p')	RPD ≤ 25	1	1	100.00
EPA 8081A	DDT(p,p')	RPD ≤ 25	1	1	100.00
EPA 8081A	Dicofol	RPD ≤ 25	1	1	100.00
EPA 8081A	Dieldrin	RPD ≤ 25	1	1	100.00
EPA 8081A	Endrin	RPD ≤ 25	1	1	100.00
EPA 8081A	Methoxychlor	RPD ≤ 25	1	1	100.00
EPA 8081A	Bifenthrin	RPD ≤ 25	1	1	100.00
EPA 8081A	Cyfluthrin, total	RPD ≤ 25	1	1	100.00
EPA 8081A	Cypermethrin, total	RPD ≤ 25	1	1	100.00
EPA 8081A	Esfenvalerate/Fenvalerate, total	RPD ≤ 25	1	1	100.00
EPA 8081A	Cyhalothrin, lambda, total	RPD ≤ 25	1	1	100.00
EPA 8081A	Permethrin, total	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Azinphos methyl	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Chlorpyrifos	RPD ≤ 25	1	0	0.00
EPA 8141A OP	Diazinon	RPD ≤ 25	1	0	0.00
EPA 8141A OP	Dimethoate	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Disulfoton	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Malathion	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Methidathion	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Parathion, Methyl	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Phorate	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Phosmet	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Molinate	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Thiobencarb	RPD ≤ 25	1	1	100.00

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8141A OP	Methamidophos	RPD ≤ 25	1	1	100.00
EPA 110.2	Color	RPD ≤ 25	1	1	100.00
EPA 130.2	Hardness as CaCO3	RPD ≤ 25	1	1	100.00
EPA 160.1	Total Dissolved Solids	RPD ≤ 25	1	1	100.00
EPA 180.1	Turbidity	RPD ≤ 25	1	1	100.00
EPA 300.0	Nitrate as N	RPD ≤ 25	1	1	100.00
EPA 350.2	Ammonia as N	RPD ≤ 25	1	0	0.00
EPA 351.3	Nitrogen, Total Kjeldahl	RPD ≤ 25	1	1	100.00
EPA 354.1	Nitrite as N	RPD ≤ 25	1	1	100.00
EPA 365.2	OrthoPhosphate as P	RPD ≤ 25	1	1	100.00
EPA 365.2	Phosphate as P	RPD ≤ 25	1	1	100.00
EPA 415.1	Total Organic Carbon	RPD ≤ 25	1	1	100.00
SM 9223	E. coli	RPD ≤ 25	1	1	100.00
EPA 200.8	Arsenic	RPD ≤ 25	1	1	100.00
EPA 200.8	Boron	RPD ≤ 25	1	1	100.00
EPA 200.8	Cadmium	RPD ≤ 25	1	1	100.00
EPA 200.8	Copper	RPD ≤ 25	1	1	100.00
EPA 200.8	Lead	RPD ≤ 25	1	1	100.00
EPA 200.8	Nickel	RPD ≤ 25	1	1	100.00
EPA 200.8	Selenium	RPD ≤ 25	1	0	0.00
EPA 200.8	Zinc	RPD ≤ 25	1	1	100.00
		TOTAL	59	54	91.53

Table 14. SJCDWQC summary of method blank quality control sample evaluations.

Samples were analyzed in batches with samples collected during the storm season of 2008 and are sorted by method and analyte.

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8321A CARB	Aldicarb	<RL	1	1	100.00
EPA 8321A CARB	Carbaryl	<RL	1	1	100.00
EPA 8321A CARB	Carbofuran	<RL	1	1	100.00
EPA 8321A CARB	Methiocarb	<RL	1	1	100.00
EPA 8321A CARB	Methomyl	<RL	1	1	100.00
EPA 8321A CARB	Oxamyl	<RL	1	1	100.00
EPA 8321A CARB	Diuron	<RL	1	1	100.00
EPA 8321A CARB	Linuron	<RL	1	1	100.00
EPA 619	Atrazine	<RL	1	1	100.00
EPA 619	Cyanazine	<RL	1	1	100.00
EPA 619	Simazine	<RL	1	1	100.00
EPA 547M	Glyphosate	<RL	1	1	100.00
EPA 549.2M	Paraquat dichloride	<RL	1	1	100.00
EPA 8081A	DDD(p,p')	<RL	1	1	100.00
EPA 8081A	DDE(p,p')	<RL	1	1	100.00
EPA 8081A	DDT(p,p')	<RL	1	1	100.00
EPA 8081A	Dicofol	<RL	1	1	100.00
EPA 8081A	Dieldrin	<RL	1	1	100.00
EPA 8081A	Endrin	<RL	1	1	100.00
EPA 8081A	Methoxychlor	<RL	1	1	100.00
EPA 8081A	Bifenthrin	<RL	1	1	100.00
EPA 8081A	Cyfluthrin, total	<RL	1	1	100.00
EPA 8081A	Cypermethrin, total	<RL	1	1	100.00
EPA 8081A	Esfenvalerate/Fenvalerate, total	<RL	1	1	100.00
EPA 8081A	Cyhalothrin, lambda, total	<RL	1	1	100.00
EPA 8081A	Permethrin, total	<RL	1	1	100.00
EPA 8141A OP	Azinphos methyl	<RL	1	1	100.00
EPA 8141A OP	Chlorpyrifos	<RL	1	1	100.00
EPA 8141A OP	Diazinon	<RL	1	1	100.00
EPA 8141A OP	Dimethoate	<RL	1	1	100.00
EPA 8141A OP	Disulfoton	<RL	1	1	100.00
EPA 8141A OP	Malathion	<RL	1	1	100.00
EPA 8141A OP	Methidathion	<RL	1	1	100.00
EPA 8141A OP	Parathion, Methyl	<RL	1	1	100.00
EPA 8141A OP	Phorate	<RL	1	1	100.00
EPA 8141A OP	Phosmet	<RL	1	1	100.00
EPA 8141A OP	Molinate	<RL	1	1	100.00
EPA 8141A OP	Thiobencarb	<RL	1	1	100.00
EPA 8141A OP	Methamidophos	<RL	1	1	100.00
EPA 110.2	Color	<RL	1	1	100.00
EPA 130.2	Hardness as CaCO3	<RL	1	1	100.00

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 160.1	Total Dissolved Solids	<RL	1	1	100.00
EPA 180.1	Turbidity	<RL	1	1	100.00
EPA 300.0	Nitrate as N	<RL	2	2	100.00
EPA 350.2	Ammonia as N	<RL	1	1	100.00
EPA 351.3	Nitrogen, Total Kjeldahl	<RL	2	2	100.00
EPA 354.1	Nitrite as N	<RL	1	1	100.00
EPA 365.2	OrthoPhosphate as P	<RL	1	1	100.00
EPA 365.2	Phosphate as P	<RL	1	1	100.00
EPA 415.1	Total Organic Carbon	<RL	2	2	100.00
SM 9223	E. coli	<RL	1	1	100.00
EPA 200.8	Arsenic	<RL	2	2	100.00
EPA 200.8	Boron	<RL	2	2	100.00
EPA 200.8	Cadmium	<RL	2	2	100.00
EPA 200.8	Copper	<RL	2	2	100.00
EPA 200.8	Lead	<RL	2	2	100.00
EPA 200.8	Nickel	<RL	2	2	100.00
EPA 200.8	Selenium	<RL	2	2	100.00
EPA 200.8	Zinc	<RL	2	2	100.00
		TOTAL	70	70	100.00

Table 15. SJCDWQC summary of lab control spike quality control sample evaluations.

Laboratory control spikes and laboratory control spike duplicates were analyzed in batches with samples collected during the storm season of 2008 and are sorted by method and analyte.

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8321A CARB	Aldicarb	PR 31-133	1	1	100.00
EPA 8321A CARB	Carbaryl	PR 44-133	1	1	100.00
EPA 8321A CARB	Carbofuran	PR 36-165	1	1	100.00
EPA 8321A CARB	Methiocarb	PR 35-142	1	1	100.00
EPA 8321A CARB	Methomyl	PR23-152	1	1	100.00
EPA 8321A CARB	Oxamyl	PR 10-117	1	1	100.00
EPA 8321A CARB	Diuron	PR 52-136	1	1	100.00
EPA 8321A CARB	Linuron	PR 49-144	1	1	100.00
EPA 619	Atrazine	PR 39-156	1	1	100.00
EPA 619	Cyanazine	PR 22-172	1	1	100.00
EPA 619	Simazine	PR 21-179	1	1	100.00
EPA 547M	Glyphosate	PR 72-131	2	2	100.00
EPA 549.2M	Paraquat dichloride	PR 50-126	1	1	100.00
EPA 8081A	DDD(p,p')	PR 38-135	1	1	100.00
EPA 8081A	DDE(p,p')	PR 21-134	1	1	100.00
EPA 8081A	DDT(p,p')	PR 18-145	1	1	100.00
EPA 8081A	Dicofol	PR 40-135	1	1	100.00
EPA 8081A	Dieldrin	PR 48-121	1	1	100.00
EPA 8081A	Endrin	PR 24-143	1	1	100.00
EPA 8081A	Methoxychlor	PR 30-163	1	1	100.00
EPA 8081A	Bifenthrin	PR 52-117	1	1	100.00
EPA 8081A	Cyfluthrin	PR 53-125	1	1	100.00
EPA 8081A	Cypermethrin	PR 55-107	1	1	100.00
EPA 8081A	Esfenvalerate/Fenvalerate, total	PR 52-117	1	1	100.00
EPA 8081A	Cyhalothrin, lambda, total	PR 62-104	1	1	100.00
EPA 8081A	Permethrin, total	PR 24-166	1	1	100.00
EPA 8141A OP	Azinphos methyl	PR 36-189	1	1	100.00
EPA 8141A OP	Chlorpyrifos	PR 61-125	1	1	100.00
EPA 8141A OP	Diazinon	PR 57-130	1	1	100.00
EPA 8141A OP	Dimethoate	PR 68-202	1	1	100.00
EPA 8141A OP	Disulfoton	PR 47-117	1	1	100.00
EPA 8141A OP	Malathion	PR 47-125	1	1	100.00
EPA 8141A OP	Methidathion	PR 50-150	1	1	100.00
EPA 8141A OP	Parathion, Methyl	PR 55-164	1	1	100.00
EPA 8141A OP	Phorate	PR 44-117	1	1	100.00
EPA 8141A OP	Phosmet	PR 50-150	1	1	100.00
EPA 8141A OP	Molinate	PR 50-150	1	1	100.00
EPA 8141A OP	Thiobencarb	PR 50-150	1	1	100.00
EPA 8141A OP	Methamidophos	PR 40-135	1	1	100.00
EPA 110.2	Color	PR 80-120	1	1	100.00
EPA 130.2	Hardness as CaCO3	PR 80-120	1	1	100.00

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 160.1	Total Dissolved Solids	PR 80-120	1	1	100.00
EPA 180.1	Turbidity	PR 90-110	1	1	100.00
EPA 300.0	Nitrate as N	PR 90-110	2	2	100.00
EPA 350.2	Ammonia as N	PR 90-110	1	1	100.00
EPA 351.3	Nitrogen, Total Kjeldahl	PR 90-110	2	2	100.00
EPA 354.1	Nitrite as N	PR 80-120	1	1	100.00
EPA 365.2	OrthoPhosphate as P	PR 90-110	1	1	100.00
EPA 365.2	Phosphate as P	PR 90-110	1	1	100.00
EPA 415.1	Total Organic Carbon	PR 80-120	2	2	100.00
SM 9223	E. coli	PR 80-120			NA
EPA 200.8	Arsenic	PR 85-115	2	2	100.00
EPA 200.8	Boron	PR 85-115	2	2	100.00
EPA 200.8	Cadmium	PR 85-115	2	2	100.00
EPA 200.8	Copper	PR 85-115	2	2	100.00
EPA 200.8	Lead	PR 85-115	2	2	100.00
EPA 200.8	Nickel	PR 85-115	2	2	100.00
EPA 200.8	Selenium	PR 85-115	2	2	100.00
EPA 200.8	Zinc	PR 85-115	2	2	100.00
		TOTAL	70	70	100.00

Table 16. SJCDWQC summary of lab control spike duplicate quality control sample evaluations.

Laboratory control spikes and laboratory control spike duplicates were analyzed in batches with samples collected during the storm season of 2008 and are sorted by method and analyte.

Method	Analyte	Data Quality Objective	Number of Pairs	Pairs Within Control Limits	Percent Samples Acceptable
EPA 8321A CARB	Aldicarb	RPD ≤ 25			NA
EPA 8321A CARB	Carbaryl	RPD ≤ 25			NA
EPA 8321A CARB	Carbofuran	RPD ≤ 25			NA
EPA 8321A CARB	Methiocarb	RPD ≤ 25			NA
EPA 8321A CARB	Methomyl	RPD ≤ 25			NA
EPA 8321A CARB	Oxamyl	RPD ≤ 25			NA
EPA 8321A CARB	Diuron	RPD ≤ 25			NA
EPA 8321A CARB	Linuron	RPD ≤ 25			NA
					NA
EPA 619	Atrazine	RPD ≤ 25			NA
EPA 619	Cyanazine	RPD ≤ 25			NA
EPA 619	Simazine	RPD ≤ 25			NA
EPA 547M	Glyphosate	RPD ≤ 25	1	1	100.00
EPA 549.2M	Paraquat dichloride	RPD ≤ 25			NA
EPA 8081A	DDD(p,p')	RPD ≤ 25			NA
EPA 8081A	DDE(p,p')	RPD ≤ 25			NA
EPA 8081A	DDT(p,p')	RPD ≤ 25			NA
EPA 8081A	Dicofol	RPD ≤ 25			NA
EPA 8081A	Dieldrin	RPD ≤ 25			NA
EPA 8081A	Endrin	RPD ≤ 25			NA
EPA 8081A	Methoxychlor	RPD ≤ 25			NA
EPA 8081A	Bifenthrin	RPD ≤ 25			NA
EPA 8081A	Cyfluthrin	RPD ≤ 25			NA
EPA 8081A	Cypermethrin	RPD ≤ 25			NA
EPA 8081A	Esfenvalerate/Fenvalerate, total	RPD ≤ 25			NA
EPA 8081A	Cyhalothrin, lambda, total	RPD ≤ 25			NA
EPA 8081A	Permethrin, total	RPD ≤ 25			NA
EPA 8141A OP	Azinphos methyl	RPD ≤ 25			NA
EPA 8141A OP	Chlorpyrifos	RPD ≤ 25			NA
EPA 8141A OP	Diazinon	RPD ≤ 25			NA
EPA 8141A OP	Dimethoate	RPD ≤ 25			NA
EPA 8141A OP	Disulfoton	RPD ≤ 25			NA
EPA 8141A OP	Malathion	RPD ≤ 25			NA
EPA 8141A OP	Methidathion	RPD ≤ 25			NA
EPA 8141A OP	Parathion, Methyl	RPD ≤ 25			NA
EPA 8141A OP	Phorate	RPD ≤ 25			NA
EPA 8141A OP	Phosmet	RPD ≤ 25			NA
EPA 8141A OP	Molinate	RPD ≤ 25			NA

Method	Analyte	Data Quality Objective	Number of Pairs	Pairs Within Control Limits	Percent Samples Acceptable
EPA 8141A OP	Thiobencarb	RPD ≤ 25			NA
EPA 8141A OP	Methamidophos	RPD ≤ 25			NA
EPA 110.2	Color	RPD ≤ 25			NA
EPA 130.2	Hardness as CaCO3	RPD ≤ 25			NA
EPA 160.1	Total Dissolved Solids	RPD ≤ 25			NA
EPA 180.1	Turbidity	RPD ≤ 25			NA
EPA 300.0	Nitrate as N	RPD ≤ 25			NA
EPA 350.2	Ammonia as N	RPD ≤ 25			NA
EPA 351.3	Nitrogen, Total Kjeldahl	RPD ≤ 25			NA
EPA 354.1	Nitrite as N	RPD ≤ 25			NA
EPA 365.2	OrthoPhosphate as P	RPD ≤ 25			NA
EPA 365.2	Phosphate as P	RPD ≤ 25			NA
EPA 415.1	Total Organic Carbon	RPD ≤ 25			NA
SM 9223	E. coli	RPD ≤ 25			NA
EPA 200.8	Arsenic	RPD ≤ 25			NA
EPA 200.8	Boron	RPD ≤ 25			NA
EPA 200.8	Cadmium	RPD ≤ 25			NA
EPA 200.8	Copper	RPD ≤ 25			NA
EPA 200.8	Lead	RPD ≤ 25			NA
EPA 200.8	Nickel	RPD ≤ 25			NA
EPA 200.8	Selenium	RPD ≤ 25			NA
EPA 200.8	Zinc	RPD ≤ 25			NA
		TOTAL	1	1	100.00

Table 17. SJCDWQC summary of matrix spike quality control sample evaluations.

Matrix spikes and matrix spike duplicates were collected during the storm season of 2008. Included in the following table are NONAG matrix spikes included for batch quality assurance purposes. Evaluations are sorted by method and analyte.

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8321A CARB	Aldicarb	PR 31-133	2	2	100.00
EPA 8321A CARB	Carbaryl	PR 44-133	2	2	100.00
EPA 8321A CARB	Carbofuran	PR 36-165	2	2	100.00
EPA 8321A CARB	Methiocarb	PR 35-142	2	2	100.00
EPA 8321A CARB	Methomyl	PR23-152	2	2	100.00
EPA 8321A CARB	Oxamyl	PR 10-117	2	2	100.00
EPA 8321A CARB	Diuron	PR 52-136	2	0	0.00
EPA 8321A CARB	Linuron	PR 49-144	2	2	100.00
EPA 619	Atrazine	PR 39-156	2	2	100.00
EPA 619	Cyanazine	PR 22-172	2	2	100.00
EPA 619	Simazine	PR 21-179	2	0	0.00
EPA 547M	Glyphosate	PR 72-131	2	2	100.00
EPA 549.2M	Paraquat dichloride	PR 50-126	2	0	0.00
EPA 8081A	DDD(p,p')	PR 38-135	2	2	100.00
EPA 8081A	DDE(p,p')	PR 21-134	2	2	100.00
EPA 8081A	DDT(p,p')	PR 18-145	2	2	100.00
EPA 8081A	Dicofol	PR 40-135	2	2	100.00
EPA 8081A	Dieldrin	PR 48-121	2	2	100.00
EPA 8081A	Endrin	PR 24-143	2	2	100.00
EPA 8081A	Methoxychlor	PR 30-163	2	2	100.00
EPA 8081A	Bifenthrin	PR 52-117	2	2	100.00
EPA 8081A	Cyfluthrin	PR 53-125	2	2	100.00
EPA 8081A	Cypermethrin	PR 55-107	2	2	100.00
EPA 8081A	Esfenvalerate/Fenvalerate, total	PR 52-117	2	2	100.00
EPA 8081A	Cyhalothrin, lambda, total	PR 62-104	2	0	0.00
EPA 8081A	Permethrin, total	PR 24-166	2	2	100.00
EPA 8141A OP	Azinphos methyl	PR 36-189	2	1	50.00
EPA 8141A OP	Chlorpyrifos	PR 61-125	2	0	0.00
EPA 8141A OP	Diazinon	PR 57-130	2	2	100.00
EPA 8141A OP	Dimethoate	PR 68-202	2	2	100.00
EPA 8141A OP	Disulfoton	PR 47-117	2	2	100.00
EPA 8141A OP	Malathion	PR 47-125	2	2	100.00
EPA 8141A OP	Methidathion	PR 50-150	2	2	100.00
EPA 8141A OP	Parathion, Methyl	PR 55-164	2	2	100.00
EPA 8141A OP	Phorate	PR 44-117	2	2	100.00
EPA 8141A OP	Phosmet	PR 50-150	2	2	100.00

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8141A OP	Molinate	PR 50-150	2	2	100.00
EPA 8141A OP	Thiobencarb	PR 50-150	2	2	100.00
EPA 8141A OP	Methamidophos	PR 40-135	2	2	100.00
EPA 110.2	Color	PR 80-120			NA
EPA 130.2	Hardness as CaCO3	PR 80-120	2	2	100.00
EPA 160.1	Total Dissolved Solids	PR 80-120			NA
EPA 180.1	Turbidity	PR 90-110			NA
EPA 300.0	Nitrate as N	PR 90-110	4	2	50.00
EPA 350.2	Ammonia as N	PR 90-110	2	2	100.00
EPA 351.3	Nitrogen, Total Kjeldahl	PR 90-110	4	4	100.00
EPA 354.1	Nitrite as N	PR 80-120	2	2	100.00
EPA 365.2	OrthoPhosphate as P	PR 90-110	2	2	100.00
EPA 365.2	Phosphate as P	PR 90-110	2	2	100.00
EPA 415.1	Total Organic Carbon	PR 80-120	4	4	100.00
SM 9223	E. coli	PR 80-120			NA
EPA 200.8	Arsenic	PR 85-115	4	4	100.00
EPA 200.8	Boron	PR 85-115	4	2	50.00
EPA 200.8	Cadmium	PR 85-115	4	4	100.00
EPA 200.8	Copper	PR 85-115	4	4	100.00
EPA 200.8	Lead	PR 85-115	4	4	100.00
EPA 200.8	Nickel	PR 85-115	4	4	100.00
EPA 200.8	Selenium	PR 85-115	4	4	100.00
EPA 200.8	Zinc	PR 85-115	4	3	75.00
		TOTAL	132	116	87.88

Table 18. SJCDWQC summary of matrix spike duplicate quality control sample evaluations.

Matrix spikes and matrix spike duplicates were collected during the storm season of 2008. Included in the following table are NONAG matrix spikes included for batch quality assurance purposes. Evaluations are sorted by method and analyte.

Method	Analyte	Data Quality Objective	Number of Pairs	Pairs Within Control Limits	Percent Samples Acceptable
EPA 8321A CARB	Aldicarb	RPD ≤ 25	1	1	100.00
EPA 8321A CARB	Carbaryl	RPD ≤ 25	1	1	100.00
EPA 8321A CARB	Carbofuran	RPD ≤ 25	1	1	100.00
EPA 8321A CARB	Methiocarb	RPD ≤ 25	1	1	100.00
EPA 8321A CARB	Methomyl	RPD ≤ 25	1	1	100.00
EPA 8321A CARB	Oxamyl	RPD ≤ 25	1	1	100.00
EPA 8321A CARB	Diuron	RPD ≤ 25	1	1	100.00
EPA 8321A CARB	Linuron	RPD ≤ 25	1	1	100.00
EPA 619	Atrazine	RPD ≤ 25	1	1	100.00
EPA 619	Cyanazine	RPD ≤ 25	1	1	100.00
EPA 619	Simazine	RPD ≤ 25	1	1	100.00
EPA 547M	Glyphosate	RPD ≤ 25	1	1	100.00
EPA 549.2M	Paraquat dichloride	RPD ≤ 25	1	1	100.00
EPA 8081A	DDD(p,p')	RPD ≤ 25	1	1	100.00
EPA 8081A	DDE(p,p')	RPD ≤ 25	1	1	100.00
EPA 8081A	DDT(p,p')	RPD ≤ 25	1	1	100.00
EPA 8081A	Dicofol	RPD ≤ 25	1	1	100.00
EPA 8081A	Dieldrin	RPD ≤ 25	1	1	100.00
EPA 8081A	Endrin	RPD ≤ 25	1	1	100.00
EPA 8081A	Methoxychlor	RPD ≤ 25	1	1	100.00
EPA 8081A	Bifenthrin	RPD ≤ 25	1	1	100.00
EPA 8081A	Cyfluthrin	RPD ≤ 25	1	1	100.00
EPA 8081A	Cypermethrin	RPD ≤ 25	1	1	100.00
EPA 8081A	Esfenvalerate/Fenvalerate, total	RPD ≤ 25	1	1	100.00
EPA 8081A	Cyhalothrin, lambda, total	RPD ≤ 25	1	1	100.00
EPA 8081A	Permethrin, total	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Azinphos methyl	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Chlorpyrifos	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Diazinon	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Dimethoate	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Disulfoton	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Malathion	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Methidathion	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Parathion, Methyl	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Phorate	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Phosmet	RPD ≤ 25	1	1	100.00

Method	Analyte	Data Quality Objective	Number of Pairs	Pairs Within Control Limits	Percent Samples Acceptable
EPA 8141A OP	Molinate	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Thiobencarb	RPD ≤ 25	1	1	100.00
EPA 8141A OP	Methamidophos	RPD ≤ 25	1	1	100.00
EPA 110.2	Color	RPD ≤ 25			NA
EPA 130.2	Hardness as CaCO3	RPD ≤ 25	1	1	100.00
EPA 160.1	Total Dissolved Solids	RPD ≤ 25			NA
EPA 180.1	Turbidity	RPD ≤ 25			NA
EPA 300.0	Nitrate as N	RPD ≤ 25	2	2	100.00
EPA 350.2	Ammonia as N	RPD ≤ 25	1	1	100.00
EPA 351.3	Nitrogen, Total Kjeldahl	RPD ≤ 25	2	2	100.00
EPA 354.1	Nitrite as N	RPD ≤ 25	1	1	100.00
EPA 365.2	OrthoPhosphate as P	RPD ≤ 25	1	1	100.00
EPA 365.2	Phosphate as P	RPD ≤ 25	1	1	100.00
EPA 415.1	Total Organic Carbon	RPD ≤ 25	2	2	100.00
SM 9223	E. coli	RPD ≤ 25			NA
EPA 200.8	Arsenic	RPD ≤ 25	2	2	100.00
EPA 200.8	Boron	RPD ≤ 25	2	2	100.00
EPA 200.8	Cadmium	RPD ≤ 25	2	2	100.00
EPA 200.8	Copper	RPD ≤ 25	2	2	100.00
EPA 200.8	Lead	RPD ≤ 25	2	2	100.00
EPA 200.8	Nickel	RPD ≤ 25	2	2	100.00
EPA 200.8	Selenium	RPD ≤ 25	2	2	100.00
EPA 200.8	Zinc	RPD ≤ 25	2	2	100.00
		TOTAL	66	66	100.00

Table 19. SJCDWQC summary of lab duplicate quality control sample evaluations.

Samples were analyzed in batches with samples collected during the storm season of 2008 and also include NONAG samples included for batch quality assurance purposes; sorted by method and analyte.

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8321A CARB	Aldicarb	RPD ≤ 25			NA
EPA 8321A CARB	Carbaryl	RPD ≤ 25			NA
EPA 8321A CARB	Carbofuran	RPD ≤ 25			NA
EPA 8321A CARB	Methiocarb	RPD ≤ 25			NA
EPA 8321A CARB	Methomyl	RPD ≤ 25			NA
EPA 8321A CARB	Oxamyl	RPD ≤ 25			NA
EPA 8321A CARB	Diuron	RPD ≤ 25			NA
EPA 8321A CARB	Linuron	RPD ≤ 25			NA
EPA 619	Atrazine	RPD ≤ 25			NA
EPA 619	Cyanazine	RPD ≤ 25			NA
EPA 619	Simazine	RPD ≤ 25			NA
EPA 547M	Glyphosate	RPD ≤ 25	1	1	100.00
EPA 549.2M	Paraquat dichloride	RPD ≤ 25			NA
EPA 8081A	DDD(p,p')	RPD ≤ 25			NA
EPA 8081A	DDE(p,p')	RPD ≤ 25			NA
EPA 8081A	DDT(p,p')	RPD ≤ 25			NA
EPA 8081A	Dicofol	RPD ≤ 25			NA
EPA 8081A	Dieldrin	RPD ≤ 25			NA
EPA 8081A	Endrin	RPD ≤ 25			NA
EPA 8081A	Methoxychlor	RPD ≤ 25			NA
EPA 8081A	Bifenthrin	RPD ≤ 25			NA
EPA 8081A	Cyfluthrin, total	RPD ≤ 25			NA
EPA 8081A	Cypermethrin, total	RPD ≤ 25			NA
EPA 8081A	Esfenvalerate/Fenvalerate, total	RPD ≤ 25			NA
EPA 8081A	Cyhalothrin, lambda, total	RPD ≤ 25			NA
EPA 8081A	Permethrin, total	RPD ≤ 25			NA
EPA 8141A OP	Azinphos methyl	RPD ≤ 25			NA
EPA 8141A OP	Chlorpyrifos	RPD ≤ 25			NA
EPA 8141A OP	Diazinon	RPD ≤ 25			NA
EPA 8141A OP	Dimethoate	RPD ≤ 25			NA
EPA 8141A OP	Disulfoton	RPD ≤ 25			NA
EPA 8141A OP	Malathion	RPD ≤ 25			NA
EPA 8141A OP	Methidathion	RPD ≤ 25			NA
EPA 8141A OP	Parathion, Methyl	RPD ≤ 25			NA
EPA 8141A OP	Phorate	RPD ≤ 25			NA
EPA 8141A OP	Phosmet	RPD ≤ 25			NA

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8141A OP	Molinate	RPD ≤ 25			NA
EPA 8141A OP	Thiobencarb	RPD ≤ 25			NA
EPA 8141A OP	Methamidophos	RPD ≤ 25			NA
EPA 110.2	Color	RPD ≤ 25	1	1	100.00
EPA 130.2	Hardness as CaCO3	RPD ≤ 25			NA
EPA 160.1	Total Dissolved Solids	RPD ≤ 25	1	1	100.00
EPA 180.1	Turbidity	RPD ≤ 25	1	1	100.00
EPA 300.0	Nitrate as N	RPD ≤ 25			NA
EPA 350.2	Ammonia as N	RPD ≤ 25			NA
EPA 351.3	Nitrogen, Total Kjeldahl	RPD ≤ 25			NA
EPA 354.1	Nitrite as N	RPD ≤ 25			NA
EPA 365.2	OrthoPhosphate as P	RPD ≤ 25			NA
EPA 365.2	Phosphate as P	RPD ≤ 25			NA
EPA 415.1	Total Organic Carbon	RPD ≤ 25			NA
SM 9223	E. coli	RPD ≤ 25	1	1	100.00
EPA 200.8	Arsenic	RPD ≤ 25			NA
EPA 200.8	Boron	RPD ≤ 25			NA
EPA 200.8	Cadmium	RPD ≤ 25			NA
EPA 200.8	Copper	RPD ≤ 25			NA
EPA 200.8	Lead	RPD ≤ 25			NA
EPA 200.8	Nickel	RPD ≤ 25			NA
EPA 200.8	Selenium	RPD ≤ 25			NA
EPA 200.8	Zinc	RPD ≤ 25			NA
		TOTAL	5	5	100.00

Table 20. SJCDWQC summary of surrogate recovery quality control sample evaluations.

Surrogates were run with water samples collected and LABQAs analyzed during the storm season of 2008 for all organics except paraquat and glyphosate. Included are NONAG samples. Evaluations are sorted by method and analyte.

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8321A CARB	Isoxaben(Surrogate)	RPD ≤ 25; PR 36-140	20	20	100.00
EPA 8321A CARB	Tributylphosphate(Surrogate)	RPD ≤ 25; PR 36-140	20	20	100.00
EPA 8321A CARB	Triphenyl phosphate(Surrogate)	RPD ≤ 25; PR 56-129			NA
EPA 619	Tributylphosphate(Surrogate)	RPD ≤ 25; PR 62-145	20	20	100.00
EPA 619	Triphenyl phosphate(Surrogate)	RPD ≤ 25; PR 54-144	20	20	100.00
EPA 8081A	Decachlorobiphenyl(Surrogate)	RPD ≤ 25; PR 16-146	20	20	100.00
EPA 8081A	Tetrachloro-m-xylene(Surrogate)	RPD ≤ 25; PR 15-98	20	20	100.00
EPA 8141A OP	Tributylphosphate(Surrogate)	RPD ≤ 25; PR 60-150	39	39	100.00
EPA 8141A OP	Triphenyl phosphate(Surrogate)	RPD ≤ 25; PR 56-129	39	28	71.79
		TOTAL	198	187	94.44

Table 21. SJCDWQC summary of holding time evaluations for environmental, field blank, field duplicate and matrix spike samples collected during the storm season of 2008; sorted by method and analyte.

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8321A CARB	Aldicarb	7 days	17	17	100.00
EPA 8321A CARB	Carbaryl	7 days	17	17	100.00
EPA 8321A CARB	Carbofuran	7 days	17	17	100.00
EPA 8321A CARB	Methiocarb	7 days	17	17	100.00
EPA 8321A CARB	Methomyl	7 days	17	17	100.00
EPA 8321A CARB	Oxamyl	7 days	17	17	100.00
EPA 8321A CARB	Diuron	7 days	17	17	100.00
EPA 8321A CARB	Linuron	7 days	17	17	100.00
EPA 619	Atrazine	7 days	17	17	100.00
EPA 619	Cyanazine	7 days	17	17	100.00
EPA 619	Simazine	7 days	17	17	100.00
EPA 547M	Glyphosate	14 days	17	17	100.00
EPA 549.2M	Paraquat dichloride	7 days	17	17	100.00
EPA 8081A	DDD(p,p')	7 days	17	17	100.00
EPA 8081A	DDE(p,p')	7 days	17	17	100.00
EPA 8081A	DDT(p,p')	7 days	17	17	100.00
EPA 8081A	Dicofol	7 days	17	17	100.00
EPA 8081A	Dieldrin	7 days	17	17	100.00
EPA 8081A	Endrin	7 days	17	17	100.00
EPA 8081A	Methoxychlor	7 days	17	17	100.00
EPA 8081A	Bifenthrin	7 days	14	14	100.00
EPA 8081A	Cyfluthrin	7 days	14	14	100.00
EPA 8081A	Cypermethrin	7 days	14	14	100.00
EPA 8081A	Esfenvalerate/Fenvalerate, total	7 days	14	14	100.00
EPA 8081A	Cyhalothrin, lambda, total	7 days	14	14	100.00
EPA 8081A	Permethrin, total	7 days	14	14	100.00
EPA 8141A OP	Azinphos methyl	7 days	16	16	100.00
EPA 8141A OP	Chlorpyrifos	7 days	16	16	100.00
EPA 8141A OP	Diazinon	7 days	16	16	100.00
EPA 8141A OP	Dimethoate	7 days	16	16	100.00
EPA 8141A OP	Disulfoton	7 days	16	16	100.00
EPA 8141A OP	Malathion	7 days	16	16	100.00
EPA 8141A OP	Methidathion	7 days	16	16	100.00
EPA 8141A OP	Parathion, Methyl	7 days	16	16	100.00
EPA 8141A OP	Phorate	7 days	16	16	100.00
EPA 8141A OP	Phosmet	7 days	16	16	100.00
EPA 8141A OP	Molinate	7 days	17	17	100.00

Method	Analyte	Data Quality Objective	Number of Samples	Samples Within Control Limits	Percent Samples Acceptable
EPA 8141A OP	Thiobencarb	7 days	17	17	100.00
EPA 8141A OP	Methamidophos	7 days	16	16	100.00
EPA 110.2	Color	48 hours	16	16	100.00
EPA 130.2	Hardness as CaCO3	6 months	11	11	100.00
EPA 160.1	Total Dissolved Solids	48 hours	16	16	100.00
EPA 180.1	Turbidity	48 hours	16	16	100.00
EPA 300.0	Nitrate as N	48 hours	11	11	100.00
EPA 350.2	Ammonia as N	Field acidify, 28 days	11	11	100.00
EPA 351.3	Nitrogen, Total Kjeldahl	Field acidify, 28 days	11	11	100.00
EPA 354.1	Nitrite as N	48 hours	11	11	100.00
EPA 365.2	OrthoPhosphate as P	48 hours	11	11	100.00
EPA 365.2	Phosphate as P	Field acidify, 28 days	11	11	100.00
EPA 415.1	Total Organic Carbon	28 days	18	18	100.00
SM 9223	E. coli	24 hours	16	16	100.00
EPA 200.8	Arsenic	Field acidify, 40 days	11	11	100.00
EPA 200.8	Boron	Field acidify, 40 days	11	11	100.00
EPA 200.8	Cadmium	Field acidify, 40 days	11	11	100.00
EPA 200.8	Copper	Field acidify, 40 days	11	11	100.00
EPA 200.8	Lead	Field acidify, 40 days	11	11	100.00
EPA 200.8	Nickel	Field acidify, 40 days	11	11	100.00
EPA 200.8	Selenium	Field acidify, 40 days	11	11	100.00
EPA 200.8	Zinc	Field acidify, 40 days	11	11	100.00
		TOTAL	881	881	100.00

Table 22. SJCDWQC summary of toxicity retest evaluations due to failed toxicity criteria for samples collected during the storm season of 2008; sorted by method and species.

Method	Toxicity Species	Total Samples	Total Samples Retested	Percent Samples Within Acceptable Criteria
EPA 821/R-02-012	*Ceriodaphnia dubia*	17	0	100.00
EPA 821/R-02-012	*Pimephales promelas*	15	0	100.00
EPA 821/R-02-013	*Selenastrum capricornutum*	20	0	100.00
EPA 600/R-99-064	*Hyalella azteca*	19	0	100.00

Table 23. SJCDWQC summary of toxicity field duplicate sample evaluations collected during the storm season of 2008; sorted by method and species.

Method	Toxicity Species	Total Field Duplicate Samples	Data Quality Objective (DQO)	Total Field Duplicate Samples Within DQO	Percent Samples Within Acceptable Criteria
EPA 821/R-02-012	*Ceriodaphnia dubia*	1	RPD ≤ 25	1	100.00
EPA 821/R-02-012	*Pimephales promelas*	1	RPD ≤ 25	1	100.00
EPA 821/R-02-013	*Selenastrum capricornutum*	2	RPD ≤ 25	0	0.00
EPA 600/R-99-064	*Hyalella azteca*	1	RPD ≤ 25	1	100.00

Pesticide Use Information

All exceedances for the 2008 storm sampling are provided in Table 27 to Table 30 in the following section, Data Interpretation. Pesticide use reports (PURs) for October 2007 through March 2008 were requested from all the counties within the Coalition region. These PUR data can be found in Appendix IV. It should be noted that this information is direct from the Ag Commissioners and is considered preliminary. The data is reported exactly as it is received and may include errors and/or omissions.

For each sampling period in which chemicals, metals or toxicity were detected, all reported pesticide use data for one to six months prior to sampling (depending on exceedance, Table 24) were collected for the specific site subwatersheds based on Township-Range-Section (TRS). All pesticide products that contained the chemicals and metals detected are listed by site subwatershed and applications are provided on maps. Pesticide use is reported as amount of product used. Some products may have more than one active ingredient and in this case the product appears more than once with the name of the chemical ingredient. Data are not available for individual fields or parcels except where they coincide with complete sections. Where consecutive exceedances are reported and more than one month of data is provided, only pesticide use from the previous monitoring date are provided. The maps show only the additional use.

Dieldrin exceedances are not listed below since there are no registered products with this active ingredient, and nitrate/nitrite/nitrogen exceedances are not listed since the use of these products are not reported.

Table 24. Pesticide use data collected for reported exceedences.

Exceedance Type	Pesticides Use Data Collected
Pesticides in water column	1 month, except pyrethroids 6 months
Metals (copper) in water column	3 months
Sediment Toxicity – *Hyalella azteca*	3 months with 6 months for pyrethroids
Water column toxicity – *Selenastrum capricornutum, Pimephales promelas* and *Ceriodaphnia dubia*	1 months with 6 months for pyrethroids

Data Interpretation

A summary of exceedances that occurred during monitoring over the 2008 storm season is presented in Tables 27-30. Water quality trigger limits (WQTLs) used to determine exceedances are provided in Table 26.

Discrepancies exist between exceedances reported in this document and those submitted as exceedance reports to the CVRWQCB during the 2008 storm monitoring season. The discrepancies are a result of either a change of the water quality trigger limits or the units of calculations used for the purpose of reporting results. These discrepencies include detections that were either not reported in official exceedance reports or that were reported incorrectly (Table 25).

Exceedances of cadmium included in this report were not reported during the 2008 storm season due to a change in the WQTL for cadmium, applied on March 13, 2008. As a result, six exceedances of cadmium were detected after monitoring results for the storm monitoring event had been reported. These exceedances occurred across six of the Coalition monitoring sites, as shown in Table 25, below.

In addition, discrepancies occurred between the initial percentages reported for *Selenastrum capricornutum* toxicity and those included in this report. *Selenastrum* toxicity test results are reported from the laboratory in both absorbance units and cells/mL (calculated based on absorbance). Initially a percent relative to the control was calculated based on the reported absorbance, however the percent relative to the control values entered into the Coalition database were calculated based on cell counts. As a result, the percentages reported in the initial exceedance reports may vary slightly from the final exceedances shown below.

Table 25. Exceedance discrepancies that occurred during the 2008 storm season.

Results are sorted by analyte and station name.

Station Name	Sample Date	Sample Time	Analyte	Reported unit	Exceedance Report	Current Report
French Camp Slough @ Airport Way	01/23/08	17:00	cadmium	µg/L	Not Reported	0.06
Grant Line Canal @ Clifton Court Rd	01/23/08	15:10	cadmium	µg/L	Not Reported	0.1
Grant Line Canal near Calpack Rd	01/23/08	13:40	cadmium	µg/L	Not Reported	0.08
Lone Tree Creek @ Jack Tone Rd	01/23/08	17:10	cadmium	µg/L	Not Reported	0.2
Marsh Creek @ Concord Ave	01/23/08	11:50	cadmium	µg/L	Not Reported	0.06
Terminous Tract Drain @ Hwy 12	01/23/08	7:50	cadmium	µg/L	Not Reported	0.08
Grant Line Canal @ Clifton Court Rd	1/23/2008	15:10	*S. capricornutum* toxicity	% growth relative to control	21	19
Grant Line Canal near Calpack Rd	1/23/2008	13:40	*S. capricornutum* toxicity	% growth relative to control	3.7	2
Grant Line Canal near Calpack Rd	1/30/2008	9:30	*S. capricornutum* toxicity	% growth relative to control	30	25
Lone Tree Creek @ Jack Tone Rd	1/23/2008	17:10	*S. capricornutum* toxicity	% growth relative to control	62	61
Roberts Island Drain @ Holt Rd	1/23/2008	9:10	*S. capricornutum* toxicity	% growth relative to control	1.4	1
Terminous Tract Drain @ Hwy 12	1/23/2008	7:50	*S. capricornutum* toxicity	% growth relative to control	11	8

Table 26. Water Quality Trigger Limits (WQTLs) for constituents and parameters measured during Coalition monitoring.

Constituent	Water Quality Trigger Limit (WQTL)	Standard Type	Beneficial Use (BU) with most protective limit	Reference for the Trigger Limit
Field and Physical Parameters				
pH	6.5 - 8.5 units	Numeric		Sacramento/San Joaquin Rivers Basin Plan (page III.6.00)
Electrical Conductivity (maximum)	700 umhos/cm	Narrative	Agricultural Supply	Water Quality for Agriculture (Ayers & Westcot)
Dissolved Oxygen (minimum)	7 mg/L	Numeric	Cold Freshwater Habitat, Spawning	Sacramento/San Joaquin Rivers Basin Plan. Water Quality Control Plan for the Tulare Lake Basin.
	5 mg/L		Warm water habitat	Basin Plan Objective, page III-5.00: for waters designated WARM (aquatic life). Tulare Lake Basin Plan
Total Dissolved Solids	450 mg/L	Narrative	Agricultural Supply	Water Quality for Agriculture (Ayers & Westcot)
Turbidity	variable	Numeric	Municipal and Domestic Supply	Basin Plan Objective - increase varies based on natural turbidity
E. coli	235 MPN/100 ml			EPA ambient water quality criteria, single-sample maximum
TOC	NA			
Pesticides - Carbamates				
Aldicarb	3 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan Chemical Constituents Objective, USEPA Primary MCL (MUN, human health)
Carbaryl	2.53 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective: Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game) (aquatic life). Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game)
Carbofuran	ND	Numeric		Sacramento/San Joaquin Basin Plan - Basin Plan Prohibition, page IV-25.00 (MUN, human health)
Methiocarb	0.5 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates/Resour.Publ.137, Fish Wildl.Serv., U.S.D.I., Washington, D.C :98 p. (OECDG Data File) -(Detect at .5 ug/L - no limit set)
Methomyl	0.52 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game) (aquatic life)
Oxamyl	50 ug/L	Numeric	Municipal and Domestic Supply	Basin Plan, page III-3.00, under "Chemical constituents." Drinking Water Standards - Maximum Contaminant Levels (MCLs). California Dept of Health Services. Primary MCL
Pesticides - Organochlorines				
DDD(p,p')	0.00083 ug/L	Numeric	Municipal and Domestic Supply	Basin Plan (page III-6.00, pesticides, third bullet). CTR, Human Health Protection, 30-Day Average - Sources of Drinking Water (water & fish consumption)
DDE(p,p')	0.00059 ug/L			

Constituent	Water Quality Trigger Limit (WQTL)	Standard Type	Beneficial Use (BU) with most protective limit	Reference for the Trigger Limit
DDT(p,p')	0.00059 ug/L			
Dicofol	NA			
Dieldrin	0.00014 ug/L	Numeric	Municipal and Domestic Supply	CTR, Human Health Protection, 30-Day Average - Sources of Drinking Water (water & fish consumption)
Endrin	0.036 ug/L	Numeric	Cold Freshwater Habitat, Spawning	CTR, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average
Methoxychlor	0.03 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective, USEPA National Ambient Water Quality Criteria - Freshwater Aquatic Life Protection - instantaneous maximum (aquatic life)
Pesticides - Organophosphates				
Azinphos methyl	0.01 ug/L	Narrative	Cold Freshwater Habitat, Spawning	National Ambient Water Quality Criteria - Freshwater Aquatic Life Protection (Instantaneous)
Chlorpyrifos	0.015 ug/L	Numeric	Cold Freshwater Habitat, Spawning	Sacramento/San Joaquin Rivers Basin Plan, page III-6.01; San Joaquin River & Delta, pending Sacramento & Feather Rivers (aquatic life); more stringent 4-day average selected over less stringent 1-hour average (Central Valley Regional Water Quality Control Board; recent ammendment for Diazinon and Chlorpyrifos in the Lower San Joaquin River).
Diazinon	0.1 ug/L	Numeric	Cold Freshwater Habitat, Spawning	Sacramento San Joaquin Basin Plan, San Joaquin River & Delta numeric standard pending Sacramento & Feather Rivers numeric standard
Dimethoate	1.0 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective, Notification Level – DHS (MUN, human health). California Notification Levels. (Department of Health Services)
Disulfoton	0.05 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective, USEPA National Ambient Water Quality Criteria - Freshwater Aquatic Life Protection - instantaneous
Malathion	ND	Numeric		Sacramento/San Joaquin Basin Plan - Basin Plan Discharge Prohibition, page IV-25.00
Methamidophos	0.35 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan Toxicity Objective, Drinking Water Health Advisories or Suggested No-Adverse-Response Levels for non-cancer health effects. USEPA IRIS Reference Dose (RfD) as a drinking water level.
Methidathion	0.7	Narrative	Municipal and Domestic Supply	Basin Plan Toxicity Objective, USEPA IRIS Reference Dose (MUN, human health)
Parathion, Methyl	ND	Numeric		Sacramento/San Joaquin Basin Plan - Basin Plan Prohibition, page IV-25.00

Constituent	Water Quality Trigger Limit (WQTL)	Standard Type	Beneficial Use (BU) with most protective limit	Reference for the Trigger Limit
Phorate	0.7 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan Toxicity Objective, Drinking Water Health Advisories or Suggested No-Adverse-Response Levels for non-cancer health effects. USEPA IRIS Reference Dose (RfD) as a drinking water level.
Phosmet	140 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan Toxicity Objective, Drinking Water Health Advisories or Suggested No-Adverse-Response Levels for non-cancer health effects. USEPA IRIS Reference Dose (RfD) as a drinking water level.
Pesticides - Pyrethroids				
Biphenthrin	110 ug/L	Narrative		Basin Plan Toxicity Objective, USEPA IRIS Reference Dose (human health)
Cypermethrin, total	0.002 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game)(aquatic life)
Cyhalothrin, lambda, total	35 ug/L	Narrative		Basin Plan Toxicity Objective, USEPA IRIS Reference Dose (MUN, human health)
Permethrin, total	0.03 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game) (aquatic life). USEPA National Ambient Water Quality Criteria, CA DFG, 2000
Cyfluthrin, total	NA			
Esfenvalerate/ Fenvalerate, total	NA			
Pesticides - Herbicides				
Atrazine	1.0 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan, page III-3.00, under "Chemical constituents." California Primary MCL
Cyanazine	1.0 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan Toxicity Objective, USEPA Health Advisory (human health)
Diuron	2 ug/L	Narrative	Municipal and Domestic Supply	One-in-a-Million Incremental Cancer Risk Estimates for Drinking Water. USEPA Health Advisory. Likely to be carcinogenic to humans (U.S. Environmental Protection Agency, 2005 Guidelines for Carcinogen Risk Assessment). Value modified using more recent information in USEPA Office of Pesticide Programs Registration Eligibility Decisions Documents. From Reference 36. (August 2007 Update Edition of the WQG)
Glyphosate	700 ug/L	Numeric	Municipal and Domestic Supply	Basin Plan Chemical Constituents Objective, page III-3.00, California Primary MCL (MUN, human health)
Linuron	1.4 ug/L	Narrative	Municipal and Domestic Supply	USEPA IRIS Reference Dose as a drinking water level*

Constituent	Water Quality Trigger Limit (WQTL)	Standard Type	Beneficial Use (BU) with most protective limit	Reference for the Trigger Limit
Molinate	ND	Numeric		Sacramento/San Joaquin Basin Plan - Basin Plan Discharge Prohibition, page IV-25.00
Paraquat dichloride	3.2 ug/L	Narrative	Municipal and Domestic Supply	USEPA IRIS Reference Dose as a drinking water level*
Simazine	4.0 ug/L	Numeric	Municipal and Domestic Supply	Basin Plan Chemical Constituents Objective, California Primary MCL (MUN, human health)
Thiobencarb	ND	Numeric		Sacramento/San Joaquin Basin Plan - Basin Plan Discharge Prohibition, page IV-25.00
Metals (c)				
Arsenic	10 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan Chemical Constituents Objective, USEPA Primary MCL (MUN, human health)
Boron	700 ug/L	Narrative	Agricultural Supply	Water Quality for Agriculture (Ayers & Westcot)
Cadmium	For aquatic life; variable (see cadmium worksheet). For MUN, trigger limit is 0.04 regardless of hardness value	Numeric	Cold Freshwater Habitat, Spawning/ Municipal and Domestic Supply	Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - Varies with water hardness/ California Public Health Goal for Drinking Water
Copper	For aquatic life; variable (see copper worksheet). For MUN, trigger limit is 170 regardless of hardness value	Numeric	Cold Freshwater Habitat, Spawning/ Municipal and Domestic Supply	Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - Varies with water hardness/ California Public Health Goal for Drinking Water
Lead	For aquatic life; variable (see Lead worksheet). For MUN, trigger limit is 2.0 regardless of hardness value	Numeric	Cold Freshwater Habitat, Spawning/ Municipal and Domestic Supply	CTR Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - varies with water hardness/ CA Public Health Goal for Drinking Water
Nickel	For aquatic life variable (see Nickel worksheet). For MUN nickel trigger limit is 12 ug/L regardless of hardness value	Numeric	Cold Freshwater Habitat, Spawning / Municipal and Domestic Supply	Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - varies with water hardness/ CA Public Health Goal for Drinking Water
Selenium	50 ug/L	Numeric	Municipal and Domestic Supply	California Primary MCL
Selenium	5 ug/L (4-day average)	Numeric	Cold Freshwater Habitat, Spawning	Table III-1: Trace Element Water Quality Objective. Applicable Water Bodies - San Joaquin River, mouth of the Merced River to Vernalis. Also CTR

Constituent	Water Quality Trigger Limit (WQTL)	Standard Type	Beneficial Use (BU) with most protective limit	Reference for the Trigger Limit
Zinc	For aquatic life variable (see Zinc worksheet). For MUN nickel trigger limit is 5000 ug/L regardless of hardness value	Numeric	Cold Freshwater Habitat, Spawning, Municipal and Domestic Supply	Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - varies with water hardness/ CA Public Health Goal for Drinking Water
Nutrients				
Nitrate as NO3 Nitrate as N	45,000 ug/L as NO3 10,000 ug/L as N	Numeric	Municipal and Domestic Supply	California Primary MCL
Nitrite as Nitrogen	1,000 ug/L as N	Numeric	Municipal and Domestic Supply	California Primary MCL
Ammonia	For aquatic life variable (see ammonia worksheet). For MUN ammonia trigger limit is 1.5 mg/L regardless of pH and Temperature values	Numeric	Cold Freshwater Habitat, Spawning/ Municipal and Domestic Supply	USEPA Freshwater Aquatic Life Criteria, Continuous Concentration/ Taste and Odor Threshold
Hardness	NA			
Phosphorus, total	NA			
Orthophosphate, soluble	NA			
TKN	NA			

NA = Not Available. Until completion of evaluation studies and MRP Plan submittals with site specific information on beneficial uses.
ND = Non Detect.

Table 27. Exceedances of field parameters; sorted by station name and sample date.

Station Name	Sample Date	Sample Time	Oxygen, Dissolved, mg/L	pH, none	Specific Conductivity, µS/cm
Grant Line Canal @ Clifton Court Rd	01/23/08	15:10	4.33		1483
Grant Line Canal @ Clifton Court Rd	01/30/08	9:00	3.2		1625
Grant Line Canal @ Clifton Court Rd	03/18/08	10:20	5.97		1759
Grant Line Canal near Calpack Rd	01/23/08	13:40	5.49		1736
Grant Line Canal near Calpack Rd	01/30/08	9:30	5.34		1877
Grant Line Canal near Calpack Rd	03/18/08	10:50			1891
Kellogg Creek along Hoffman Ln	03/18/08	12:20		9.26	
Lone Tree Creek @ Jack Tone Rd	01/23/08	17:10	3.79		
Marsh Creek @ Concord Ave	01/23/08	11:50			1135
Marsh Creek @ Concord Ave	03/18/08	13:00			930
Mormon Slough @ Jack Tone Rd	03/18/08	8:30	5.19		
Roberts Island Drain @ Holt Rd	01/23/08	9:10			1046
Roberts Island Drain @ Holt Rd	01/30/08	8:30	6.17		1857
Roberts Island Drain @ Holt Rd	03/18/08	9:40	5.13		1393
Roberts Island Drain along House Rd	01/23/08	8:10			1297
Roberts Island Drain along House Rd	03/18/08	9:20			2815
Sand Creek @ Hwy 4 Bypass	01/23/08	10:40			1058
Sand Creek @ Hwy 4 Bypass	03/18/08	13:30			1400
Sand Creek @ Hwy 4 Bypass	04/09/08	8:50			2034
Terminous Tract Drain @ Hwy 12	01/23/08	7:50			1454
Terminous Tract Drain @ Hwy 12	01/30/08	7:30			1479

Table 28. Pesticides exceedances in water column.

Station Name	Sample Type Code	Sample Date	Sample Time	Chlorpyrifos, µg/L	DDE (p,p'), µg/L	DDT (p,p'), µg/L	Diazinon, µg/L	Diuron, µg/L	Simazine, µg/L
French Camp Slough @ Airport Way	E	01/23/08	17:00				0.12	3.3	
Grant Line Canal @ Clifton Court Rd	E	01/23/08	15:10	0.14					
Lone Tree Creek @ Jack Tone Rd	E	01/23/08	17:10	1.7			0.2	4.9	
Mormon Slough @ Jack Tone Rd	E	01/23/08	12:00						5.4
Roberts Island Drain @ Holt Rd	E	01/23/08	9:10					17	
Roberts Island Drain along House Rd	E	01/23/08	8:10		0.011	0.014			
Sand Creek @ Hwy 4 Bypass	E	01/23/08	10:40				0.11		
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	FB	01/23/08	15:40	0.022					
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	FD	01/23/08	15:40	0.079				7.8	8.4
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	E	01/23/08	15:40	0.045				7.7	6.4

E = Environmental sample; FB = Field Blank; FD = Field Duplicate

Table 29. Inorganics/Physical Parameters exceedances in water column.

The hardness value for copper is included in parenthesis along with the copper result.

Station Name	Sample Type Code	Sample Date	Sample Time	Ammonia as N	Arsenic, µg/L	Boron, µg/L	Cadmium, µg/L	Copper, µg/L (hardness)	Color, color units	Dissolved Solids, mg/L	*E. coli*, MPN/100 mL	Lead, µg/L
Duck Creek @ Hwy 4	E	01/23/08	13:06						60		240	
French Camp Slough @ Airport Way	E	01/23/08	17:00				0.06		85		390	
Grant Line Canal @ Clifton Court Rd	E	01/23/08	15:10				0.1		120	1100		
Grant Line Canal near Calpack Rd	E	01/23/08	13:40				0.08		30	1200		
Littlejohns Creek @ Jack Tone Rd	E	01/23/08	14:30						40			
Lone Tree Creek @ Jack Tone Rd	E	01/23/08	17:10	10			0.2	40 (260)	400	580	2400	2.9
Marsh Creek @ Concord Ave	E	01/23/08	11:50			3200	0.06		35	730	580	
Mormon Slough @ Jack Tone Rd	E	01/23/08	12:00						65			
Roberts Island Drain @ Holt Rd	E	01/23/08	9:10						60	700		
Roberts Island Drain along House Rd	E	01/23/08	8:10						1800	1100		
Sand Creek @ Hwy 4 Bypass	E	01/23/08	10:40						65	750	1400	
Terminous Tract Drain @ H wy 12	FD	01/23/08	7:50		11		0.08		85	900		
Terminous Tract Drain @ Hwy 12	E	01/23/08	7:50						100	940		
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	E	01/23/08	15:40						180		2400	

E = Environmental sample; FD = Field Duplicate

Table 30. Toxicity exceedances and results of TIE studies.

Station Name	Sample Type Code	Sample Date	Sample Time	Species	Toxicity End Point	Mean	Percent Control	Toxicity Significance	Summary Comments
French Camp Slough @ Airport Way	FD	03/18/08	11:20	*Hyalella azteca*	Survival (%)	89	94	SG	RPD 5.5; Resampled on 4/9/08; toxicity was not persistent.
Grant Line Canal @ Clifton Court Rd	E	01/23/08	15:10	*Ceriodaphnia dubia*	Survival (%)	0	0	SL	TIE and dilution series was initiated on 1/27/08 and concluded that OP insecticides was the probable cause of toxicity. Resampled on 01/30/08; toxicity was not persistent.
Grant Line Canal @ Clifton Court Rd	E	01/23/08	15:10	*Selenastrum capricornutum*	Total Cell Count	283081	19	SL	TIE was initiated on 2/1/08 and concluded that cationic metals and non-polar organics were the probable cause of toxicity. Resampled on 01/30/08; toxicity was not persistent.
Grant Line Canal near Calpack Rd	E	01/23/08	13:40	*Selenastrum capricornutum*	Total Cell Count	22561	2	SL	TIE was initiated on 2/1/08 and concluded that cationic metals was the probable cause of toxicity. Resampled on 01/30/08.
Grant Line Canal near Calpack Rd	RS	01/30/08	9:30	*Selenastrum capricornutum*	Total Cell Count	110486	25	SL	Resample due to *S. capricornutum* toxicity on 01/23/08; toxicity was persistent.
Kellogg Creek along Hoffman Ln	E	03/18/08	12:20	*Hyalella azteca*	Survival (%)	26	29	SL	Resampled on 4/9/08.
Kellogg Creek along Hoffman Ln	RS	04/09/08	9:50	*Hyalella azteca*	Survival (%)	65	72	SL	Resample due to *H. azteca* toxicity on 03/18/08, toxicity was persistent.
Lone Tree Creek @ Jack Tone Rd	E	01/23/08	17:10	*Ceriodaphnia dubia*	Survival (%)	0	0	SL	Sample had strong odor of manure, contained high levels of suspended solids and had extremely high oxygen demand. Due to low and unstable DO values, a TIE was not conducted. Resampled on 01/30/08; toxicity was not persistent.
Lone Tree Creek @ Jack Tone Rd	E	01/23/08	17:10	*Pimephales promelas*	Survival (%)	75	75	SL	Sample had strong odor of manure, contained high levels of suspended solids and had extremely high oxygen demand. Resampled on 01/30/08; toxicity was not persistent.
Lone Tree Creek @ Jack Tone Rd	E	01/23/08	17:10	*Selenastrum capricornutum*	Total Cell Count	742247	61	SL	Sample had strong odor of manure, contained high levels of suspended solids and had extremely high oxygen demand. Resampled on 01/30/08; toxicity was not persistent.
Marsh Creek @ Concord Ave	E	03/18/08	13:00	*Hyalella azteca*	Survival (%)	0	0	SL	Resampled on 4/9/08.
Marsh Creek @ Concord Ave	RS	04/09/08	9:20	*Hyalella azteca*	Survival (%)	0	0	SL	Resample due to *H. azteca* toxicity on 03/18/08, toxicity was persistent.

Station Name	Sample Type Code	Sample Date	Sample Time	Species	Toxicity End Point	Mean	Percent Control	Toxicity Significance	Summary Comments
Roberts Island Drain @ Holt Rd	E	01/23/08	9:10	*Selenastrum capricornutum*	Total Cell Count	16283	1	SL	TIE was initiated on 2/1/08 and concluded that non-polar organics were the probable cause of toxicity. Resampled on 01/30/08; toxicity was not persistent.
Sand Creek @ Hwy 4 Bypass	E	03/18/08	13:30	*Hyalella azteca*	Survival (%)	0	0	SL	Resampled on 4/9/08.
Sand Creek @ Hwy 4 Bypass	RS	04/09/08	8:50	*Hyalella azteca*	Survival (%)	0	0	SL	Resample due to *H. azteca* toxicity on 03/18/08, toxicity was persistent.
Terminous Tract Drain @ Hwy 12	E	01/23/08	7:50	*Selenastrum capricornutum*	Total Cell Count	103973	8	SL	TIE was initiated on 2/1/08. Since all toxicity was lost prior to or during TIE, therefore no useful information could be provided. Resampled on 01/30/08; toxicity was not persistent.
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	E	01/23/08	15:40	*Ceriodaphnia dubia*	Survival (%)	0	0	SL	TIE and dilution series was initiated on 1/27/08 and concluded that OP insecticides was the probable cause of toxicity. Resampled on 01/30/08; toxicity was not persistent.
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	E	03/18/08	10:10	*Hyalella azteca*	Survival (%)	51	54	SL	Resampled on 4/9/08.
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	RS	04/09/08	11:20	*Hyalella azteca*	Survival (%)	19	21	SL	Resample due to *H. azteca* toxicity on 03/18/08, toxicity was persistent.

E = Environmental sample; RS = Resample; SL = Significant Loss; TIE = Toxicity Identification Evaluation; OP = Organophosphate; DO = Dissolved Oxygen; RPD = Relative Percent Difference; QC = Quality Control

Interpretation of Results

Monitoring of ambient surface waters is conducted by the Coalition for the purpose of characterizing agricultural discharges in the Coalition area. Over the long term, monitoring data provides insight into general trends in water quality at each of the sample sites.

A series of actions taken by the Coalition to determine the potential sources of exceedances experienced during each monitoring event include:

- analysis of associated toxicity data (for organic chemistry exceedances) or the evaluation of chemistry data (for toxicity exceedances) to determine possible sources of toxicity,
- analysis of relevant Toxicity Identification Evaluation (TIE) results to determine possible causes of toxicity in sample water (for samples with greater than 50% reduction of growth or survival as compared to the control),
- review of PUR data to identify relevant applications of pesticides that occurred within the site subwatershed area prior to the sampling event,
- analysis of associated monitoring data to determine potential processes by which some physical and field exceedances (such as DO, pH, and TDS) may have occurred,
- special studies, where appropriate and cost-effective, and
- additional sampling as listed in site subwatershed management plans.

These actions were implemented on a case by case basis over the course of the 2008 storm season. All PUR data for exceedances that occurred during the 2008 storm season can be found in Appendix IV.

Toxicity

Water Column Toxicity

Toxicity in the water column can occur as a result of natural or anthropogenic causes, including the discharge, release or re-suspension of metals, pesticides, ammonia or other toxicants in a water body. The three species (*Ceriodaphnia dubia, Selenastrum capricornutum,* and *Pimephales promelas*) used in water column toxicity analyses can often be associated with detections of one or more constituents in the same sample water. Water column toxicity was experienced in 10 samples collected during the 2008 storm monitoring season. Of these, one was a result of follow-up resampling for *Selenastrum* toxicity. Of the nine samples that experienced toxicity (not including the toxic resample), three were toxic to *Ceriodaphnia*, one to *Pimephales* and five to *Selenastrum*.

Every time that a sample was toxic to one or more of the test species, the site was resampled to test for persistence of the toxicity. If complete mortality occurred in a sample, a dilution series was run and acute toxic units (TUa) were calculated. TIEs were conducted on all samples with less than 50% growth or survival relative to the control. A report describing the findings of the TIEs is included in Appendix VI. In addition, PUR data are reviewed when toxicity is experienced at a site. Applications of pesticides are queried within a relevant time frame prior to the date of sampling based on the physical properties of the applied chemical; namely the half-life and the K_{oc}. For water toxicity, herbicides and insecticides are reviewed for applications one month prior to sampling; applications of metals are reviewed for three months prior to sampling. Summaries and maps of PUR data for all toxicity and exceedances experienced during the 2008 storm season are provided in Appendix IV.

Toxicity to Ceriodaphnia dubia

Complete mortality to *Ceriodaphnia dubia* was experienced in water collected from the Grant Line Canal @ Clifton Court Rd site on January 23, 2008. In addition to toxicity, an exceedance of chlorpyrifos (0.14 µg/L) was detected in the sample collected from the same site. A dilution series was run to quantify the level of toxicity in the sample and TIE tests were performed to identify the possible causes of toxicity. Results from these analyses indicate that the water column toxicity to *Ceriodaphnia* was due to a metabolically activated, non-polar organic compound (organophosphate pesticide) at a level of 1.3 TUa. The concentration of chlorpyrifos detected in the sample water accounts for all of the toxic units experienced in the *Ceriodaphnia* TIE analysis. A query was run on all PUR data for applications of chlorpyrifos or other pesticides toxic to *Ceriodaphnia* that occurred within one month of the sample collection date. No applications were found back to July of 2007. Although the cause of toxicity can be attributed to the detection of chlorpyrifos in the sample water, the Coalition is unable to locate the source where the chlorpyrifos originates due to a lack of reported chlorpyrifos use within this site subwatershed. Explanations for this include: 1) the area of the site subwatershed is not accurate and therefore does not include all contributing parcels, 2) not all PUR data has been received and entered by the County, and 3) there is unreported use. The Coalition has attempted to contact the property owner within this site subwatershed, but the owner is undergoing long-term medical treatment and is unavailable for discussion about water flows and drainages within this area. PUR data are preliminary and may be updated over the next year as some PURs are returned late to the County. There is the chance that someone is using a chemical and not reporting however the Coalition has no way of confirming this. To evaluate this possibility, the Coalition will attempt to determine crops grown within the area that could receive chlorpyrifos applications. However this area is predominately field crop which change from year to year and we will have to reconstruct the crops grown during this period. At this time, the most relevant crops would be alfalfa and asparagus. This will be analyzed further in the Grant Line Canal @ Clifton Ct site subwatershed management plan. The Grant Line Canal @ Clifton Ct site was resampled on January 30, 2008 and was not toxic to *Ceriodaphnia*.

Samples collected from the Lone Tree Creek @ Jack Tone Rd site on January 23 caused complete mortality to *Ceriodaphnia*. A TIE could not be performed on the sample. According to the laboratory, this sample had a very strong odor of manure and solvent. The sample also contained 13.9 mg/L of ammonia, measured at the toxicity laboratory. The DO was <1 mg/L on arrival. The sample was bubbled with pure oxygen which brought the DO up to >8 mg/L.

However, at 24 hrs the DO was back down to 0.4 mg/L. On 1/26/08 the laboratory started aeration along with an aeration control, and thereafter the 24 hr DO readings were 4.1 - 6.1 mg/L. The sample was bubbled for two days and the DO was raised to 4.4 mg/L but dropped again overnight. The sample was then extracted with SPE and the through-column (stored in the refrigerator) sample has a DO of 0.4 mg/L. This sample was not a good candidate for a TIE to *Ceriodaphnia* as it could not be determined if low DO or toxicant(s) were the cause of the toxicity. Chemistry results for samples collected from the same site later revealed elevated levels of other constituents known to be toxic to *Ceriodaphnia* including chlorpyrifos (1.7 µg/L) and copper (40 µg/L). The concentration of chlorpyrifos in the sample water was sufficient to cause complete mortality to *Ceriodaphnia* (LC_{50} = 0.06 µg/L). Copper toxicity is established based on the hardness of the water however a general LC_{50} for copper is 0.3 µg/L. Therefore the amount of copper detected in the sample also would be adequate to cause complete mortality. Therefore the toxicity is most likely due to multiple factors including high levels of chlorpyrifos and copper and low levels of DO.

The Coalition was informed of a spill site that was investigated by the Regional Board upstream of the Lone Tree Creek @ Jack Tone Rd sampling location at approximately the same time Coalition sampling was conducted. An inspection by the CVRWQCB on January 30, 2008 revealed that lagoon wastewater from a dairy (Vander Schaaf Dairy #2, TRS 1S8E26) was discharging into Lone Tree Creek. Samples collected by the CVRWQCB from the creek at that time revealed extremely low levels of DO and elevated levels of ammonia and dissolved solids. Waste and nutrients discharged into the creek would be expected to cause a drop in dissolved oxygen levels in the water in response to an increase in biological activity (microbial breakdown of nutrients) and biological oxygen demand. As a result, the low levels of DO in the drain are likely a result of the discharges from the Vander Schaaf Dairy at the time of sampling.

Coalition resampling for toxicity analysis also occurred on January 30, 2008. There was no toxicity measured in the follow-up samples, indicating that the toxicity at that site was not persistent.

Toxicity to *Ceriodaphnia* occurred in samples collected from the Unnamed Drain to Lone Tree Creek. Due to complete mortality experienced in the sample water, a TIE and dilution series was conducted to determine the cause and magnitude of the toxicity. Results from these analyses indicated that the sample water contained 1.3 TUa and that the likely cause of toxicity was a metabolically activated non-polar organic chemical (such as an organophosphate pesticide). Chlorpyrifos was detected (0.045 µg/L) in the samples which accounts for close to half of the toxicity (chlorpyrifos LC_{50} = 0.06 µg/L). The only other organophosphate that was detected was diazinon (0.027 µg/L) which may have played a role as a minor toxicant (diazinon LC_{50} = 0.39 µg/L). It is possible that other constituents in addition to diazinon acted synergistically with chlorpyrifos to cause complete mortality. PUR data was examined for applications of organophosphate pesticides that occurred one month prior to sampling; however no applications were reported during this time. Other products known to be toxic to *Ceriodaphnia* that were applied within one to six months prior to sampling include bifenthrin, lamba-cyhalothrin, copper hydroxide, methyl bromide, esfenvalerate, copper oxide, and 2-4 D. See Appendix IV for a detailed table and map of these applications. Of constituents listed above, only bifenthrin (a pyrethroid) was detected in the sample water at 0.316 µg/L which is 4.5 times greater than the LC_{50} (0.07 µg/L). This site was not in Phase II sampling and therefore copper was not part of the suite of constituents for which the Coalition analyzed. Methyl bromide and 2-4 D are not required constituents for monitoring.

Toxicity to Pimephales promelas

Samples collected from the Lone Tree Creek @ Jack Tone Rd site on January 23, 2008 resulted in toxicity to *Pimephales promelas* (75% survival). *Pimephales* are the least sensitive species tested in the laboratory for all constituents except ammonia. As a result, it is often found that toxicity to *Pimephales* is a result of ammonia in the test water. The toxicity testing laboratory measured the concentration of ammonia in the Lone Tree Creek sample at 13.87 mg/L just prior to toxicity analysis. The analytical laboratory measured ammonia at 10 mg/L in water collected at the same time, a concentration 6.6 times the WQ trigger. The 25% mortality that was experienced in the *Pimephales* test species could have resulted from this level of ammonia in the test water. The samples collected from the Lone Tree Creek site contained copper (40 µg/L) and chlorpyrifos (1.7 µg/L), both of which are toxic to *Pimephales* at high concentrations (copper LC_{50}= 3631.4 µg/L, chlorpyrifos LC_{50}= 192.4 µg/L). Relative to these concentrations, it is unlikely that copper or chlorpyrifos contributed to the *Pimephales* toxicity.

A regular inspection by the CVRWQCB on January 30 in the Lone Tree Creek subwatershed revealed that wastewater from a dairy (Vander Schaaf Dairy #2) was discharging into Lone Tree Creek (upstream of the Lone Tree Creek sampling location). Field measurements were taken by the CVRWQCB for electrical conductivity, pH and water temperature, and samples were collected for the analysis of ammonia, TDS and bacteria. Preliminary results collected in the field by the CVRWQCB using an ammonia test strip showed levels of ammonia between 3 and 6 ppm downstream of the discharge along Lone Tree Creek and above 6 ppm in the dairy drain water. It is likely that this spill site was the source of ammonia, TDS, and nutrients detected in the water.

Coalition resampling for toxicity also occurred on January 30, 2008. There was no toxicity in the follow-up samples, indicating that the toxicity at that site was not persistent. However, the concentration of ammonia measured as a part of the toxicity analysis was higher in the samples collected for resampling (19.0 mg/L) than the concentration detected in the initial samples (13.87 mg/L, as mentioned above). These results indicate that other constituents or parameters in the sample water were, at least in part, responsible for the *Pimephales* toxicity in the original samples. PUR data for applications of chlorpyrifos, copper, diazinon and diuron that occurred in the site subwatershed are discussed in the following sections below.

Toxicity to Selenastrum capricornutum

In addition to the *Ceriodaphnia* toxicity, samples collected from the Grant Line Canal @ Clifton Court Rd site experienced toxicity to *Selenastrum* (20% growth compared to the control). A TIE indicated non-polar organics (i.e. an herbicide) and cationic metals were potential causes of the toxicity. The baseline toxicity measured in the Phase I TIE was 82% growth as compared to the control and therefore it appears that a large amount of the toxicity was lost between the initial test and the start of the TIE. Results from the chemistry analysis indicate no exceedance-level detections of any non-polar organics or cationic metal toxicants except for cadmium (0.1 µg/L). There were detections of diuron (0.92 µg/L), linuron (0.6 µg/L), copper (7.3 µg/L), zinc (10 µg/L) and nickel (12 µg/L), all of which are below respective EC_{50} values. According to the Phase III TIE results (see Appendix IV), metals account for 0.8 TUc and diuron and linuron account for 0.5 TUc (total TUc = 1.3). PUR data for all relevant pesticide applications that have the potential to cause *Selenastrum* toxicity were queried; no relevant applications were made since August of 2007. Possible reasons for a lack of PUR information are described in the section on *Ceriodaphnia* toxicity. Grant Line Canal @ Clifton Court Rd was resampled on January 30, 2008 to test for toxicity persistence; no toxicity to *Selenastrum* was detected.

Selenastrum toxicity was experienced in samples collected from the Grant Line Canal near Calpack Rd sample site. A TIE was triggered for this sample due to less than 50% growth relative to the control, which indicated that the suspected cause of toxicity was cationic metal(s). There were no exceedance-level detections of metals in these samples but there were detections below the WQTL for a number of metals which could have acted synergistically to reduce *Selenastrum* growth during the toxicity test. These metals include copper (3.1 µg/L), nickel (7.1 µg/L) and zinc (4 µg/L) accounting for a portion of the toxicity present in the sample (total TUc = 0.4). A small component of the toxicity may be due to non-polar organics (herbicides) however no herbicides were detected in the samples. The metals detected in the sample water may be from various allochthonous (naturally high levels that occur in the soils) or anthropogenic sources. PUR data was queried for applications of pesticides containing any of the detected metals and but there were no applications. However, herbicides that have the potential to cause *Selenastrum* toxicity and were applied to alfalfa fields in the site subwatershed include paraquat, hexazinone, diuron and pendimethalin. The applications occurred between January 11, 2008 and January 20, 2008 (see Appendix IV for application information).

In addition to the *Ceriodaphnia* and *Pimephales* toxicity experienced in samples collected from the Lone Tree Creek @ Jack Tone Rd site, samples exhibited toxicity to *Selenastrum* (62% growth relative to the control). Chemistry results for samples collected from the site had elevated levels of copper (40 µg/L) and diuron (4.9 µg/L). The concentrations of these constituents in the sample water would be sufficient to cause a reduction in growth of *Selenastrum* and therefore the toxicity was likely a result of copper and/or diuron concentrations in the water column. PUR data for applications of pesticides containing copper and diuron were examined to determine possible sources and are discussed in the "Pesticides" and "Metals" sections below. Resampling for *Selenastrum* toxicity occurred on January 30, 2008. There was no toxicity in the resamples indicating that the toxicity at this site was not persistent.

Selenastrum toxicity was experienced in samples collected from the Roberts Island Drain @ Holt Rd sample site. A TIE was triggered for this sample due to less than 50% growth relative to the control. Results from the TIE showed that the suspected cause of toxicity was a non-polar organic, such as an herbicide. Diuron was detected in the sample water at a concentration of 17 µg/L. There were no other herbicide or metal exceedances at this site. The diuron detected in the sample water is the most likely cause of *Selenastrum* toxicity. PUR data for this site subwatershed show applications of diuron occurring on January 11 and January 23, 2008. A total of 117 gallons of diuron was used over 197 acres of alfalfa fields.

Selenastrum toxicity was experienced in samples collected from the Terminous Tract Drain @ Hwy 12. A TIE was triggered for this sample but toxicity was lost prior to or during the TIE treatments and therefore the evaluation was inconclusive. *Selenastrum* toxicity is often a result of herbicides or metals in the water sample. There were detections of simazine (1.4 µg/L), copper (3.1 µg/L), nickel (4.3 µg/L), and zinc (6 µg/L). None of the detections were above their respective WQTLs. In addition to simazine (EC_{50} = 1,240), copper, nickel and zinc, a constituent not tested by the Coalition may have contributed to the toxicity at this site. PUR data for applications of any herbicides (one month prior to sampling) or metals (three months prior to sampling) were compiled for the site subwatershed to determine potential sources of the toxicity. PUR data include applications of diuron, hexazinone and paraquat that occurred on January 17 and 20, 2008.

Sediment Toxicity

Storm sediment samples were collected for the analysis of toxicity to *Hyalella azteca* on March 18, 2008. Resamples were collected to test for the persistence of toxicity on April 9, 2008. A total of nine samples were toxic to *Hyalella* with four of those being resamples. Chemistry analysis was not conducted for the sediment samples and as a result the Coalition relies on PUR data to determine possible sources of sediment toxicity at a site. Applications of pesticides with a high soil organic carbon partitioning coefficient (K_{oc}) that are relevant to *Hyalella* toxicity are summarized and mapped for each of the sites that experience toxicity (Appendix IV). The relevant time frame during which applications could have an effect on the sediment at the time of sampling is six months prior to the sample collection date for pyrethroid pesticides and three months prior to sampling for all other pesticides. A discussion of each of the sediment toxicity exceedances and possible sources of toxicity are provided below.

The field duplicate sample collected from the French Camp Slough @ Airport Way site experienced sediment toxicity during monitoring conducted on March 18, 2008. Toxicity was not apparent in the corresponding normal monitoring sample, which experienced 99 percent survival relative to the control. When evaluating toxicity, it important to examine both the statistical significance of the test for differences between the control and the sample as well as the mean survival of the sample. The toxicity observed in the field duplicate (94 percent relative to the control) was greater than 80% survival which is the test acceptability criteria for a control. A control for *Hyalella* could be run and used with a 94% survival. Although the French Camp Slough sample was significantly different than the control, the level of toxicity was not ecologically significant. French Camp Slough @ Airport Way was the only site that did not experienced toxicity in the resample collected on April 9, 2008. PUR data for the French Camp Slough included numerous applications of pyrethroid pesticides within six months of the date of sampling (Appendix IV). The toxicity experienced in the sample water was minimal and may have been a result of any of a number of constituents or factors.

Samples collected from the Kellogg Creek along Hoffman Ln site experienced sediment toxicity during monitoring conducted on March 18, 2008 and during the resampling event that occurred on April 9, 2008. Toxicity in the sediment was reduced in the resample (72% survival as compared to the control) compared to the initial sample (29% survival as compared to the control), but was still persistent. PUR data included applications of several herbicides and pesticides prior to sediment sampling (Appendix IV). Chemicals that were applied include pyrethrin, bifenthrin, lambda-cyhalothrin, glyphosate, oxyflourfen, bromoxynil octanoate and paraquat. It is possible that any of these constituents bound to the sediment may have caused toxicity to *Hyalella*, and therefore the source of the toxicity cannot be specifically determined.

Marsh Creek @ Concord Ave samples collected on March 18, 2008 experienced complete mortality to *Hyalella* as did the resamples collected on April 9, 2008. PUR data from the site subwatershed show applications of pyrethroid pesticides, organophosphate pesticides and herbicides prior to sampling. Pesticides applied include lambda-cyhalothrin, esfenvalerate, bromoxynil octanoate, chlorpyrifos, glyphosate, pendimethalin and pyraclostrobin.

Sand Creek @ Hwy 4 Bypass samples collected on March 18, 2008 experienced complete mortality to *Hyalella* as did the resamples collected on April 9, 2008. Between the sample and the resample dates field observations indicated a decrease of water clarity (from clear on March 18 to murky on April 9) and a decrease in observed flow (1-5 cfs to 0.1-1 cfs). While there was no reported agricultural use of pesticides known to be toxic to *Hyalella* in the site subwatershed within the relevant time frame from sampling, applications of a fungicide, mancozeb, did occur at a golf course upstream of the sample site and toxicity may have been a result of mancozeb. Alternatively, flows upstream during the winter may have mobilized sediment containing toxic constituents and that sediment could have been deposited at the Sand Creek site.

Samples collected from the Unnamed Drain to Lone Tree Creek @ Jack Tone Rd on March 18, 2008 experienced sediment toxicity. Toxicity was also experienced from samples collected during the resampling event that occurred on April 9, 2008. PUR data includes applications of pesticides occurring three months from the sample collection date. Chemicals applied include glyphosate, oxyfluorfen, esfenvalerate, pendimethalin, imazamox, pyraclostrobin, paraquat, diflubenzuron, cyprodinil, chlorpyrifos, mancozeb and lambda-cyhalothrin. Toxicity in the sediment was elevated in the resample (21% survival compared to the control) compared to the initial sample (54% survival compared to the control), however no additional applications of pesticides occurred between the initial sample and resample collection dates. Observed flow increased from 1-5 cfs in the original sampling to 5-20 cfs during the resample. In addition, water clarity decreased from cloudy (>4 inches visibility) to murky (<4 inches visibility). It is possible that during the time between the original sample and the resample there was increased mobilization of sediment. It is not certain if any of the pesticides mentioned above were the cause of toxicity in the sediment.

Pesticides

Over 753 individual analyses for pesticides (including environmental, field duplicate and field blank samples) were conducted during the 2008 storm monitoring season and a total of 18 exceedances were detected among these tests. Four of the 18 exceedances were field duplicate or field blank results and two of the exceedances were for DDT and DDE. Field duplicate and field blank exceedances are not counted for the purpose of water quality analysis (unless an exceedance occurs in the duplicate sample and not in its complimentary grab sample) because these samples are a part of quality assurance measures in the field sampling procedures. In addition, DDT is a legacy pesticide not currently used by agriculture and DDE is a degradation product of DDT. Given these considerations, 12 of the 18 detected exceedances are considered relevant for the purpose of monitoring agricultural discharge during the 2008 storm season. These 12 exceedances occurred at seven of the 15 Coalition monitoring sites during the single storm sampling event that occurred on January 23, 2008.

Herbicides accounted for six of the 12 pesticide exceedances that occurred during the 2008 storm season, with four exceedances of diuron and two exceedances of simazine (plus field duplicate exceedances for each of these) detected across five of the sample sites.

Organophosphate pesticides accounted for the other six of the 12 pesticide exceedances with three exceedances of chlorpyrifos (plus a field duplicate and field blank exceedance) and three exceedances of diazinon detected at five of the sampling sites.

Exceedances of DDE and DDT are a result of applications in the past. These pesticides are no longer registered or applied but persist because of their exceptionally high K_{oc} and long half life. It is estimated that the K_{oc} for DDT is between 100,000 and 1,000,000 depending on the source, and the half life in aquatic systems is probably over 150 years (http://www.speclab.com/compound/c50293.htm). These pesticides may be bound to sediment in the channels and mobilized periodically by unknown mechanisms including the samplers themselves.

Pesticide applications are identifiable to township, range and section (TRS) through the use of PURs. Monitoring results obtained from sampling over the 2008 storm season were compared to PURs. PUR data are considered preliminary and may include errors and/or omissions (Appendix IV). Exceedances at Coalition monitoring sites were compared to applications within the site subwatershed. Specific crops may also be associated with particular exceedances and were also identifiable through PURs. Applications of pesticides relevant to each of the exceedances detected at SJCDWQC monitoring sites are described below. All relevant PUR data are included in Appendix IV.

Exceedances of diazinon (0.12 µg/L) and diuron (3.3 µg/L) were experienced during the January 23, 2008 storm monitoring event at French Camp Slough @ Airport Way. Diazinon is an organophosphate pesticide that was banned from household use in 2004 but is still used by agriculture for pest control on a variety of fruit, vegetable, nut and field crops. PUR data indicate applications of diazinon occurred on January 14, 2008. A total of 130 gallons of diazinon were used on 347 acres of almond orchards. Diuron is an herbicide that is often used as a pre-emergent against weeds during the early spring. PUR data from within the site subwatershed show applications occurring approximately one month prior to sampling between December 26 and 28, 2007. Applications of 131 gallons of product were made on 350 acres of alfalfa. The remainder of the applications occurred on uncultured, nonagricultural lands (75 lbs).

An exceedance of chlorpyrifos (0.14 µg/L) was experienced during the January 23, 2008 storm monitoring event at Grant Line Canal @ Clifton Court Rd. PUR data for the upstream subwatershed shows no applications of chlorpyrifos back to July of 2007. As described in the toxicity section for *Ceriodaphnia*, there are three possible reasons for a lack of PUR data including the area of the site subwatershed is not accurate and therefore does not include all contributing parcels, not all PUR data has been received and entered by the County, and there is unreported use in the site subwatershed. A further discussion of this is included in the section on toxicity. The Coalition is attempting to work with the owner/grower in this site subwatershed to more accurately understand applications and the flow of tail water in this area.

The Lone Tree Creek @ Jack Tone Rd site experienced exceedances of chlorpyrifos (1.7 µg/L), diazinon (0.2 µg/L) and diuron (4.9 µg/L) during the storm monitoring event on January 23, 2008. Toxicity was also experienced in the sample water, and may be a result of pesticides or ammonia that were detected in the sample water, as described previously. According to PUR data, there were two applications of chlorpyrifos that occurred within the site subwatershed approximately six weeks prior to sampling. Due to the half-life of chlorpyrifos (approximately 30 days in the soil), it is possible that an application over one month prior to sampling could be the source of the exceedance. Applications of diazinon also occurred within the site subwatershed approximately two week prior to sampling. A total of 130 gallons of diazinon was used on 347 acres of almond orchards on January 14, 2008. The detection of diazinon in the creek is likely a result of these applications. There were no reported applications of diuron within one month of sampling, however PUR data from three months prior to sampling show the application of two products containing diuron on November 3, 2007 on 86 acres of walnut orchards. A total of 7.5 pounds were applied. Diuron is an herbicide with a relatively long aerobic soil half-life (90 days according to USDA). Therefore, though the applied amount of diuron was minimal, it is possible that the detection in the creek could have been a result of those applications.

Simazine was detected at the Mormon Slough @ Jack Tone Rd sample site above the WQTL during the storm monitoring event on January 23, 2008. Simazine is a triazine herbicide with high solubility and a short hydrolysis half-life (10 days according to the Pesticide Actions Network database). Simazine contamination in a receiving water body is not known to be toxic to *Selenastrum* at the level detected in Mormon Slough and there was no toxicity experienced in the samples collected from this site during this storm monitoring event. Simazine is a product that is commonly used on orchards as a pre-emergent herbicide during the dormant season. There was no simazine use reported within one month of the sample collection date and the last application of simazine occurred in November 2007, three months prior to sampling. Given the half-life of simazine (60 days according to USDA), it is possible that application of a simazine-containing product three months prior to sampling may have been retained in the soil and remobilized during a storm event.

An exceedance of diuron was experienced during the January 23, 2008 storm monitoring event at Roberts Island Drain @ Holt Rd. PUR data for the site subwatershed include applications of diuron occurring on January 17 (aerial application) and January 23, 2008 (ground application). Over these two days, a total of 65 pounds were applied on 197 acres of alfalfa. As a result, one or more of these applications may be the source of the exceedance.

Exceedances of DDE and DDT were experienced at the Roberts Island Drain along House Rd sample site during the storm monitoring event. DDT is an organochlorine pesticide that was used abundantly in the past but is not currently registered for agricultural use. Due to the long half-life of the constituent, DDT and its breakdown products, DDD and DDE, are still found in Coalition water bodies. It is estimated that the K_{oc} for DDT is between 100,000 and 1,000,000 depending on the source, and the half life in aquatic systems is probably over 150 years (http://www.speclab.com/compound/c50293.htm). Current agricultural pesticide applications are not the source of these detections. These pesticides may be bound to sediment in the channels and mobilized periodically by unknown mechanisms.

An exceedance of diazinon was experienced during the January 23, 2008 storm monitoring event at Sand Creek @ Hwy 4 Bypass. There was no reported use of diazinon in the Sand Creek site subwatershed in 2007 or 2008. The half-life (40 days in soil) of diazinon and therefore it is unlikely that the chemical would persist in the water or sediment at a site for over one year. As a result the source of the diazinon detected in the creek is unknown.

Quality control samples were collected from the Unnamed Drain to Lone Tree Creek @ Jack on January 23, 2008 and included field duplicates and field blanks in addition to the environmental samples. The environmental and field duplicate samples exhibited exceedances of chlorpyrifos, diuron and simazine. Chlorpyrifos was also detected in the field blank (0.022 µg/L), however this exceedance is considered an issue of field sampling contamination and is addressed in the section, Summary of Precision and Accuracy. Criteria for field blanks are less than the reporting limit (0.02 for chlorpyrifos) or less than one fifth of the environmental sample. This sample did not pass these criteria and was therefore flagged. Field crew were notified as was the laboratory, and field sampling procedures were reviewed. Field crew followed all sampling procedures which include measures to prevent contamination. For this report, the exceedances reported for the environmental sample for chlorpyrifos (0.045 µg/L), diuron (7.7 µg/L) and simazine (6.4 µg/L) are reviewed for analysis. PUR data for the Unnamed Drain sample site show no applications of chlorpyrifos occurring one month prior to sample collection, however one application of the chlorpyrifos occurred on October 24, 2007, three months prior to sampling. A total of 50 gallons were applied on 100 acres of alfalfa. Due to the chlorpyrifos soil half-life of 30 days and a K_{oc} of 1800-6000 (depending on conditions), it is possible that the chemical may have been retained in the soil for this period of time and remobilized during the storm event just prior to sampling. Diuron applications occurred within a month of the sampling event. A total of 78 gallons of diuron were applied on 208 acres of alfalfa on December 26 and 27, 2007. The soil half-life of diuron according to the USDA is 90 days; therefore applications that occurred one month prior to sampling could have persisted in the water column or soil and remobilized with storm runoff into the drain. Simazine applications also occurred within one month prior to sampling. Three applications occurred between December 14, 2007 and January 18, 2008 on 559 acres of wine grapes. It is likely that one or more of these applications were the source of the exceedance.

Metals

Metals can be divided into two groups: those metals which are currently registered for use by agriculture, and those that are not registered for use or currently applied. During the 2008 storm season, exceedances of arsenic, boron, cadmium, copper and lead were experienced. Among the five metals, only copper is known to be currently used by agriculture in the Coalition region. It is unknown if cadmium is applied via sludge fertilizer. The Coalition has no way of tracking fertilizer applications. Each time an exceedance of copper occurred, PUR data for parcels of land upstream of the sample site were reviewed for applications of products containing copper within three months of the sample date. If relevant applications occurred then it was assumed that these applications may have contributed to the exceedance experienced at the sample site.

A total of 10 exceedances of metals were experienced during the 2008 storm season. Six of the 10 exceedances were of cadmium with one exceedance each of arsenic, boron, copper and lead. These exceedances and their relevance to pesticide applications are described in more detail below.

Arsenic

Arsenic was detected at one site, Terminous Tract Drain @ Hwy 12, above the WQTL during the 2008 storm monitoring event. Arsenic is found in sodium cacodylate which is applied by agriculture for broadleaf weed control and as a cotton defoliant. The registrations on many products with this active ingredient have been cancelled. However, there are four products currently registered for use on citrus, for weed control around ditches, for use on ornamental plants, for nonagricultural weed control, and for weed control around buildings, driveways, sidewalks, rights-of-way, and fencerows. Several products are available for use by homeowners and nonagricultural users (e.g. county road maintenance) (http://www.pesticideinfo.org/List_Products.jsp?Rec_Id=PC34358&Chem_Name=Sodium%20cacodylate&PC_Code=012502) and the product may have been purchased for use by local homeowners for use on their property. California Department of Pesticide Regulation records indicate minimal use of sodium cacodylate across the Coalition region between 1996 and 2006, and in the Terminous Tract Drain there is no record of any sodium cacodylate application.

At this point the source of arsenic is unclear although native soils can contain elevated concentrations of arsenic. The Coalition is presently investigating methods for establishing background levels of arsenic in surface waters. The Coalition will work with the Regional Board to determine if it is feasible to obtain the necessary data to establish background levels.

Boron

One exceedance of boron was experienced in the Marsh Creek @ Concord Ave site for the storm monitoring event. Since the analysis of Coalition water samples for metals was initiated in 2006, boron had been frequently detected above the water quality trigger limit at the Marsh Creek sampling site. As a result, a special study was initiated in the 2007 storm monitoring season to identify the source of boron detected in Marsh Creek. Two new sites were established on Marsh Creek upstream of agricultural in an attempt to distinguish between boron naturally leached from the soils of the Coast Range and boron originating from agricultural applications. Upstream sampling was conducted during three monitoring events in 2007: two storm monitoring events and the first irrigation season monitoring event in April. The special study concluded that boron in the Marsh Creek site subwatershed is naturally occurring and is not a result of agricultural applications or management practices.

Lead

Lead is the legacy of a number of potential sources including deposition from leaded gasoline, disposal of lead-based products such as paints, electronic components, and batteries, and old applications of lead arsenate pesticides. Currently, there are no registered pesticides that contain lead, although lead arsenate was used in the past. Lead arsenate was used until the 1960s and has been banned on all food crops since 1991. Currently, the most probable source is contaminated soils that originated from old pesticide applications, disposal of products containing lead, or the past deposition of automobile exhaust along roadways. Contaminated soils may have caused contaminated sediment and that sediment may be moved into the water body during storm events. Lead is predominantly particulate bound and not bioavailable in that form. Major roads and highways within a subwatershed may contribute to the leaching of lead into receiving waterways. In addition, disposal of lead paint in the vicinity, burial of old buildings with lead paint, or leaching lead from lead arsenate deposition could all be contributors to lead detections.

Cadmium

Exceedances of cadmium occurred at six monitoring sites during the January storm monitoring event. Few exceedances of cadmium have occurred in the past, however due to a change in the WQTL that occurred in March of 2008 (the WQTL for cadmium is now in the parts per trillion and is the lowest of all of the metals tested), exceedances of cadmium have increased.

Elevated concentrations of cadmium in a water body may be a result of agricultural application of fertilizer, but also may arise from the erosion of soils and bedrock, atmospheric deposition, discharge from industrial operations or leakage from landfills and contaminated sites. The element can be found in NiCd batteries used for wireless or cordless devices such as cellular telephones and power tools among other products. Cadmium has high tendency to adsorb to sediments and persists indefinitely in the environment. Since applications of fertilizers are not tracked, the Coalition cannot identify an agricultural contribution to the detection of cadmium in the water column.

Copper

Copper was detected at a concentration above the WQTL (based on hardness) at Lone Tree Creek @ Jack Tone Rd during the storm monitoring event (40 µg/L). Copper is commonly applied throughout the Coalition region and is considered an organic herbicide, fungicide, and algaecide. It can be used on crops during the dormant season for pre-emergent pest control. Copper, copper hydroxide, copper sulfate and copper sulfate pentahydrate are found in pesticide products. Copper can also become available to water bodies through the weathering of rocks and soils that naturally contain metals. Copper is known to contribute to the toxicity of *Selenastrum*. Since copper does not degrade, it is possible that applications can cause exceedances more than one month after application. PUR data for the Lone Tree Creek @ Jack Tone Rd site subwatershed within three months of the date of sampling indicate that there were numerous applications of copper between December 2007 and January 2008. A total of 5,671 pounds of product was applied during this time on 811 acres of orchards (primarily almonds). Refer to Appendix IV for detailed PUR data and maps showing copper applications relevant to the exceedance.

Nutrients (Ammonia)

Ammonia can enter a water body through two sources, direct discharge from agricultural fertilizers or animal waste, or from discharges from waste water treatment plants. Ammonia in fertilizer is typically converted to nitrite and then nitrate in soils over a short period of time and discharge of ammonia from fertilizer would have to be immediate to detect ammonia in the receiving water body. There was one ammonia exceedance which occurred in a sample collected from the Lone Tree Creek @ Jack Tone Rd site. This ammonia exceedance has been attributed to a dairy discharge upstream of the sampling location which also caused mortality to *Pimephales* (see *Pimephales* toxicity portion of this section for further details).

Field Parameters (DO, pH, EC)

Dissolved Oxygen

There were nine exceedances of the DO WQTL (<7.0 mg/L) during the 2008 storm season. Exceedances of DO are common and have been present throughout the Coalition region since monitoring was implemented. DO and pH are expected to vary diurnally and can exceed water quality standards as a result of natural processes in the water column. These processes include changing water temperature, photosynthesis and respiration and can be exacerbated by the addition of nutrients. Nutrients stimulate productivity and eventually release the organic matter into the water column and sediment where it is broken down by microbial activity. A study to investigate the sources of low DO was conducted by the Coalition. It was found that water temperature and nitrate were significant predictors of DO. As water temperature and biological oxygen demand (BOD) increased, DO decreased. As nitrate increased, DO increased although the explanation for this latter relationship is not clear. It is clear that both water temperature and BOD are significant factors causing the decrease in DO although other, as yet unknown factors are also important.

pH

Only one exceedances of the pH water quality trigger (> 8.5) occurred during the 2008 storm season. Kellogg Creek @ Hoffman Ln had a pH of 9.26 in March during the sediment sampling. pH dynamics in surface waters are not well understood and can vary diurnally with photosynthetic rates and changes in the concentration of CO_2 and O_2 in the water. Control of pH in surface waters is a function of the balance between the buffering capacity of the water, inputs of organic acids from soil leaching, and the relative amount of photosynthesis. However, during the storm season, these factors are unlikely to affect pH substantially, with the exception of compounds leaching from soils. Exceedances of pH have occurred previously at the Kellogg Creek site; however it is uncertain what conditions are causing the exceedances. Further analysis through Management Plans may help to identify the cause of elevated pH at the Kellogg Creek site.

Specific Conductance

There were 18 exceedances of the specific conductance (EC) water quality trigger (>700 µS/cm) at 7 sites. EC exceedances occurred at each sampling event during the storm season. Further discussion of EC, as it is related to total dissolved solids (TDS), is provided in the next section.

Physical Parameters (Color and Dissolved Solids)

Color and dissolved solids (TDS) were analyzed in samples from 14 sites collected during the storm monitoring event. The color WQTL was exceeded in samples collected from every site with the exception of Mokelumne River @ Bruella Rd.

Color is a derived parameter in that it is not delivered to surface waters from any single source, with the possible exception of color derived from suspended sediments. Color is a result of other constituents (e.g. organic carbon) or processes (e.g. photosynthesis, turbulent flow and resuspension of particulate matter). Consequently, management of color is not possible unless the process(es) that contribute to color are understood. Color exceedances in different water bodies may be a result of different factors. As the Coalition conducts special studies to determine the cause(s) of exceedances of constituents such as DO and pH, information will become available that may allow the Coalition to address color exceedances.

TDS describes all solids (usually mineral salts) that are dissolved in water and are frequently associated with exceedances of EC. Samples from eight sites experienced exceedances of TDS during the January 2008 storm event. Seven of the eight TDS exceedances (not including the field duplicate) were accompanied by EC exceedances, the exception being Lone Tree Creek @ Jack Tone Rd (EC = 350 µS/cm).

Potential sources of EC and TDS are minerals leached from soils by upstream surface water and ground water, or drain water from irrigated agriculture. There are two general sources of EC (or TDS) in agricultural landscapes; fertilizers and native soils. A commercial fertilizer can be made up of dozens of different chemicals, each of which ionize and contribute to the EC of the solution. Different brands of fertilizer can use different chemicals to make up the total formula indicating that there will not be a universal signal for fertilizer-generated EC or TDS.

There are a large portion of the sites that have elevated levels of EC and TDS, such as Sand Creek, Marsh Creek, Terminous Tract Drain, Grant Line Canal, and Roberts Island Drain sites located in the Delta where surface water and ground water have elevated salt content. A large amount of this salt is accumulated from the southern San Joaquin Valley and is discharged to the San Joaquin River where it is transported to the Delta. Water with naturally high levels of TDS is used for irrigation and discharged back to the Delta where it may eventually work its way to the Pacific Ocean or be transported south in the Delta-Mendota Canal. The CVRWQCB recognizes that EC/TDS is a region-wide problem and must be solved at that level. The Coalition will work with the CVRWQCB to address the problem at a region-wide level over the next several years.

E. coli

E. coli is an indicator of fecal contamination in surface waters. There were 6 exceedances at 6 sites of the *E. coli* water quality trigger during the 2008 storm season in a total of 14 samples tested. Potential sources of *E. coli* include deposition or runoff from irrigated pasture, dairies, leaky sewer lines, leaky septic systems, application of manure, biosolids and liquid dairy waste, and a large array of wildlife. Results of a special study conducted in 2006 indicated that the source of the bacteria in the water samples was a combination of human and bovine fecal matter (as well as a small amount from poultry), depending on the location. The Coalition anticipates participating in a region-wide study to further investigate the fate and transport of *E. coli*. The study is still being developed in collaboration with Regional Board staff.

Summary of Management Practices

Management Practices to Reduce Water Use and Waste Discharge

In addition to monitoring water quality within the Coalition area, the Coalition gathers information on best management practices that have been evaluated and proven to benefit water quality. Each management practice is viewed as one tool in a collective tool box, and the management practices (tools) that are most beneficial to a particular farming operation will depend on factors such as the size of the farm, the drainage system, soil type, crop type and the agricultural pests that must be controlled. The Coalition provides this information and offers support to growers to facilitate the implementation of these management practices. Over the course of the 2008 storm monitoring season, the Coalition has collaborated with the University of California Agricultural Cooperative Extension, the Coalition for Urban and Rural Environmental Stewardship (CURES), pesticide registrants and pest control advisors, among other groups, to gather information on the most up-to-date management practices to reduce the potential of pesticide runoff. Information is provided to growers regularly throughout the year by means of Coalition outreach meetings, mailings, personal communication and the Coalition website. Meeting agendas and number of attendees are recorded at each meeting and will be included in the SJCDWQC Management Plan update. Table 33 in the Actions Taken to Address Water Quality Impacts includes dates of grower meetings that were held during the 2008 storm season.

A working list of best management practices (BMPs) is provided in Table 31 below. Management practices are constantly developing and changing and therefore the information will be updated on a regular basis. BMPs are described based on the endpoint (e.g. water conservation, waste discharge reduction, etc.) and the mechanism of the practice. CURES has developed BMP handbooks and booklets which address specific pesticide groups, crop type, and also sediment management. In addition, the University of California (UC) has developed a publication titled *Pesticide Choice: Best Management Practices for Protecting Surface Water Quality in Agriculture* that can be downloaded from their website (http://anrcatalog.ucdavis.edu/Items/8161.aspx). Relevant booklets and brochures from both CURES and the University of California have been handed out at grower meetings.

Table 31. Table of best management practices (BMPs), target constituents, mechanism and possible improvements to water quality.

BMP	BMP Endpoint	BMP Target(s)	BMP Mechanism	Effected water/sediment quality monitoring parameter(s)
Sediment basin	Reduce discharge	PI, PS, K, S, NP	Removal of sediment, pesticides bound to sediments; allow time for biodegradation of pesticides	Color, turbidity, EC, TDS, metals, short half-life pesticides, high Koc pesticides, total phosphorous
Landguard™	Reduce discharge	PI, PS (organophosphate specific)	Improve hydrolysis of organophosphate pesticides	Organophosphate pesticides
Vegetated buffers	Reduce discharge	PI, PS, K, S, NP, NN	Remove sediment, nutrients, pesticides bound to sediments, or any contaminants with low solubility	Color, turbidity, EC, TDS, metals, pesticides, nutrients
Cover crop, dormant season vegetation	Reduce discharge	K, S, NP	Removal of sediment, pesticides bound to sediments, or any contaminants with low solubility; protect soils and soil nutrients for growing season	Color, turbidity, EC, TDS, metals, pesticides, nutrients
Sprayer calibration	Reduce discharge	D	Reduce potential for spray drift	All pesticides
Polyacrylamide (PAM)	Reduce discharge	PI, K, S, NP	Removes sediment from the water column, removes pesticides and metals bound to sediments	Color, turbidity, metals, pyrethroid pesticides, total phosphorous
Dormant season field retainers	Reduce discharge	PS, S	Reduce/eliminate storm runoff	Color, turbidity, EC, TDS, copper, pyrethroid pesticides, organophosphate pesticides

BMP	BMP Endpoint	BMP Target(s)	BMP Mechanism	Effected water/sediment quality monitoring parameter(s)
Microspray irrigation	Reduce water use & discharge	D,W	Increase water use efficiency, eliminate potential for irrigation tail water return	All pesticides, sediment-bound metals
Tail water return system	Reduce water use & discharge	PI , PS, K, S, W, NP, NN	Re-use of irrigation water, eliminate discharge altogether	Color, turbidity, EC, TDS, metals, all pesticides, all nutrients

BMP Targets Code:

D: Chemical (pesticide) drift
PS: Dormant spray pesticide storm runoff
S: Sediment runoff
NP: Nutrients: phosphorous
PI: Pesticide runoff from irrigation
K: High K_{oc} pesticide runoff
W: Water use efficiency
NN: Nutrients: nitrate, nitrite or Kjeldhal nitrogen

Management Practices Implementation

Over the course of monitoring, when an exceedance occurs at a sample site more than once, the Coalition is required to formulate a management plan to address those exceedances. Management plans contain management goals and actions that are designed to address the problems specific to a site subwatershed. Best management practices, outreach and implementation are important components of the plan. The Management Plan provides a prioritization scheme and sequence by which management actions occur. Based on this plan, management practices are recommended to growers through general outreach at county or subwatershed meetings, but outreach can also occur on an individual grower basis. In some cases in the past, Coalition representatives were able to conduct site visits to individual farms in order to investigate sources of exceedances and to speak with growers or applicators in person. After outreach or contact occurs, management practices are implemented by growers on a voluntary basis. In particular, where exceedances are experienced in a small site subwatershed, it is possible to work closely with growers to encourage the implementation of management practices at an individual site.

Over the 2008 storm season, the Coalition collaborated with the UC Cooperative Extension and pest control advisors in the Grant Line Canal and Lone Tree Creek subwatersheds to provide information and resources for the implementation of BMPs specific to the sites. These two site subwatersheds are two of the four priority subwatersheds listed in the SJCDWQC Management Plan. In both of these subwatersheds, new management practices were adopted by growers based on the recommendations provided, and monitoring results have shown improvements in water quality at those sites. Details on the water quality exceedances, outreach activities, and evaluation of management practices for these site subwatersheds are included in the SJCDWQC Management Plans that will be submitted in September, 2008. Briefly, the Grant Line Canal near Calpack Rd site subwatershed has had exceedances of the chlorpyrifos WQTL (0.015 µg/L) in 2005 (March, July and August) and in 2006 (May). Three of those exceedances were associated with *Ceriodaphnia dubia* toxicity. The grower has been active in working with the Coalition and UC Cooperative Extension to review management practices that can be used on alfalfa crops and the adoption of new management practices has resulted in no chlorpyrifos or *Ceriodaphnia* exceedances since May, 2006. The Lone Tree Creek @ Jack Tone Rd subwatershed has had problems with copper and chlorpyrifos exceedances. The Coalition has focused outreach efforts in this area to meet with walnut growers to discuss management practices to reduce the amount of insecticides and copper in both storm and irrigation runoff. The Lone Tree Creek site subwatershed had exceedances for both copper and chlorpyrifos during the storm 2008 monitoring season and the Coalition is planning additional meetings specific to members who have pesticide applications which are related to past exceedances. This meeting will be held in mid-July 2008 and will focus on specific crops and management practices for those crops. Coalition representatives will also obtain information from the growers about specific management practices that are in place which will be used for further analysis in the Management Plan for this site subwatershed. The Lone Tree Creek subwatershed is much larger than the Grant Line Canal site subwatershed and therefore, despite increased outreach by the Coalition and implementation of additional management practices, improvements in water quality have not yet become apparent. The site specific management plan for the Lone Tree Creek further discusses the Coalitions strategy to improve water quality within this area.

These two subwatersheds are examples of how the management of sites within the Coalition region will occur in the long term. The Grant Line Canal had rapid improvement due to work with a single grower whereas the Lone Tree Creek area is still experiencing water quality problems despite efforts of growers within the area. The Coalition is working with growers to find the best possible solutions for their farms.

The SJCDWQC Coalition, in collaboration with the San Joaquin County Resource Conservation District and UC Agriculture and Natural Resources Cooperative Extension (UC Extension), has obtained Proposition 50 (Prop50) and California Department of Pesticide Regulation (CDPR) grants to aid in outreach, education and implementation of management practices within the Coalition region. The Prop50 grant is designed to evaluate and implement current and new management practices in regards to the efficacy and practicality of the management plans in reducing off-site movement of pollutants from agricultural runoff. Proposed efficacy studies are designed to target constituents that have been detected at Coalition monitoring sites, such as chlorpyrifos and copper. Dealing with insecticide applications, these studies include the recycling of tail water in alfalfa, using Landguard™ to treat drain water containing chlorpyrifos, the movement of chlorpyrifos in runoff in furrow irrigated corn and the use of an alternative chemical for weevil control. In addition, studies dealing with herbicide and fungicide use include smart sprayer technology to reduce herbicide volume and reduce the use of soil active herbicides, the use of a disease model to reduce copper hydroxide applications for walnut blight, the evaluation of a new formulation of copper bactericide in copper hydroxide applied for blight control, and alternative methods to aerial applications of copper-containing fungicides. Sampling that has occurred during the storm 2008 monitoring season for the Prop50 grant are included in Table 32. Sampling was conducted in January 2008 to evaluate orchard floor management practices (cover crop and discing) that influence runoff volumes and herbicide residue contained in runoff waters in the Lone Tree Creek site subwatershed. The cover crop and discing were effective in reducing discharge when storm water runoff was moderate, however once the runoff volume exceeded the infiltration rate, all treatments discharged similar volumes of water. Weather patterns over the storm season allowed only one storm to be sampled. Prop 50 sampling was also conducted to evaluate the movement of chlorpyrifos in runoff waters in furrow irrigated corn in the Duck Creek site subwatershed in April and June 2008. Water samples are still being analyzed from this study. All Prop50 results are reported to the Regional Board in quarterly reports and are not included in this SAMR.

A grant was proposed to CDPR in February titled *Management of Pesticide Runoff in the San Joaquin-Sacramento Delta and San Joaquin County Waterways*. The grant was approved in May 2008 with the following goals: 1) reduce non-point source agricultural runoff into local waterways, 2) increase the adoption of Integrated Pest Management (IPM) practices by local farmers and ranchers, 3) reinforce current required management practices with local applicators, 4) reduce the number of pesticide exceedances at each of the SJCDWQC's 15 monitoring locations, 5) develop a grower assessment workbook designed to reduce agricultural non-point source pollution (focused on top crops of the region such as corn alfalfa, tomatoes, wine grapes, and walnuts). This grant is anticipated to help the SJCDWQC conduct outreach to growers regarding BMPs and specifically IPM practices to improve water quality within the Coalition area.

Actions Taken to Address Water Quality Impacts

Ambient monitoring of surface waters is conducted by the Coalition for the purpose of characterizing discharges from agriculture in the Coalition area. Over the long term, monitoring data provide insight on the general trends in water quality at each of the sample sites. Results from each event within a monitoring season can help to identify constituents and which agricultural lands, crops and/or particular pesticides need to be managed better to reduce or eliminate discharges from agriculture. A series of actions taken to determine the potential sources of exceedances experienced during each monitoring event include 1) the use of PURs to identify relevant applications that occurred upstream of the sample site and in proximity to the sampling event, 2) an analysis of monitoring data to determine the potential mechanism associated with exceedances of physical and field parameters such as DO, pH, and TDS, and 3) special studies where appropriate and cost effective to determine the sources of constituents such as *E. coli* or the potential causes of exceedances such as low DO.

Coalition members received results of the monitoring via direct-mail from the Coalition, at grower outreach meetings and, in some cases, by personal communication. The Coalition also provided growers with information on best management practices to reduce runoff of storm water and sediments into receiving water bodies. Additional relevant management practices were presented via direct mailings and at meetings, such as ground application of pesticides (Smart Sprayer technology) and ground cover to reduce runoff during storm events.

Reporting was also conducted to inform the Regional Board and stakeholders of Coalition monitoring results and progress. The monitoring and reporting activities are summarized in Table 32 in the next section. This table also includes relevant activities performed with Prop50 money although reporting of those results are not included in this SAMR (they are reported in separate quarterly reports submitted to the Regional Board). Further detail describing all of the actions explained above is provided in this section.

Outreach and Education

Based on the results of the monitoring, the Coalition held workshops, meetings and presentations to provide useful information to all growers in the Coalition region (Table 33). Outreach and education activities are an important component of the Coalition monitoring program. The Coalition continues to make a strong effort to provide information to growers at regular meetings, as well as at meetings conducted by the County Agricultural Commissioner, and by personal contact. Coalition presentations over the past storm season provided members with general information, site subwatershed specific monitoring results, and management practices that have proven to be effective to reduce the discharge of pesticides to water bodies. Meetings were held throughout the Coalition region during January, February, March and May. As part of the Prop50 project, growers in the Lodi area were invited to the "California Cherry Research Review and Growing Sweet Cherries Organically- A Workshop" held on January 16, 2008. Management practices that were presented included delayed dormant applications, the use of cover crops and runoff treatment strategies. Also as part of the Prop50 project, on February 28, 2008 UC Extension and Coalition personnel attended the 38th Annual Tri-County Walnut Institute meeting in Stockton to discuss dormant sprays on walnut orchards in addition to management practices to implement when treating blight, coddling moth and navel orangeworm. During the spring of 2008, UC Extension personnel and Coalition representatives held an alfalfa grower meeting to discuss the use and management of chlorpyrifos applications. The attendees represented more than 90% of the 2430 acres of irrigated lands within the two Grant Line Canal site subwatersheds. Trial results from a Prop50 study conducted within the Grant Line Canal area were discussed including the efficacy of other products (Warrior and Steward) in comparison to chlorpyrifos. Discussions included how to choose a pesticide based on the chemical's half life and the properties influencing the potential for runoff. A meeting was held with landowners in San Joaquin County on March 10, 2008. Coalition representatives, pest control advisors and UC Extension personnel were also in attendance to discuss the 2008 storm monitoring exceedances, past exceedances experienced in 2007, and alternative materials and practices that may help to eliminate discharge and the likelihood of future exceedances. In addition, on March 20, 2008, an Energy, Irrigation and Regulation Workshop was held in the City of Stockton, in conjunction with the UC Extension. UC Extension specialists presented information on the current California regulations on air and water quality, and management practices to comply with the regulations as efficiently as possible. A Coalition representative, Mike Wackman, provided information on the Irrigated Lands Regulatory Program and monitoring conducted by the SJCDWQC. Additional grower outreach meetings to address exceedances occurred on May 1 and 2, 2008 in Stockton and Tracy. Exceedances information from the 2007 irrigation season and best management practices to address the exceedances in the upcoming irrigation season were presented by Coalition representatives.

In addition, with each meeting conducted, growers become familiar with the Coalition representatives. The meetings are often followed by individual discussions of monitoring results and management practices that may help prevent future problems. Follow-up discussions have led to implementation of management practices by growers, especially in site subwatersheds where exceedances have occurred more than once for a particular pesticide. The Coalition is developing ways to track implementation of new management practices and will focus on priority subwatersheds (Lone Tree Creek, Duck Slough, Grant Line Canal and Unnamed Drain to Lone Tree Creek) in the next year. This information will be included in the update to the SJCDWQC Management Plan which will be submitted in April, 2009.

The Coalition also hosts a Coalition website: http://www.sjdeltawatershed.org/. This website serves as a clearing house for Coalition activities and outreach on management practices. Information provided on the website is a useful supplement to regular grower contacts and meetings. Interested parties can find information on site subwatershed land uses, past exceedances, management plans (in development), links to BMP websites, and grower meeting dates.

Pest Control Advisors, Agricultural Commissioners and Registrants

In order for the Coalition to be most effective in providing recommendations on management practices that reduce or eliminate discharge, collaboration with County Agricultural Commissioners, Pest Control Advisors (PCA) and pesticide registrants is important. During the 2008 storm season the Coalition worked with each of these entities on a number of occasions. County Agricultural Commissioners have been active participants in the SJCDWQC Steering Committee meetings and both Ag Commissioners and PCAs attended workshops and outreach meetings.

Activities, Events and Deliverables

Table 32 and 33 provide Coalition activities, events and deliverables that have occurred during the 2008 storm monitoring season. Included in Table 32 are the dates in each month in which a Coalition event was performed. Exceedance and Communication Reports are listed as are the general class of constituent(s) (i.e. field parameters, pesticides, *E. coli*/metals/physical parameters, water column toxicity, and sediment toxicity) covered by the reports. Table 33 includes actions taken by the Coalition in response to exceedances during the 2008 storm season.

Table 32. Calendar of events and deliverables for the SJCDWQC relevant to the 2008 storm season.

Date	Action Item
1/4/2008	Prop50 Orchard Floor Management Practices Evaluation Sampling
1/5/2008	Prop50 Orchard Floor Management Practices Evaluation Sampling
1/23/2008	Storm1 Normal Monitoring Event
1/23/2008	Field Exceedance Report – Storm1 Monitoring
1/29/2008	Toxicity Exceedance Report – Storm1 Monitoring
1/30/2008	Storm1 Toxicity Resampling Event
1/30/2008	Field Exceedance Report – Storm1 Resampling
2/5/2008	Toxicity Exceedance Report – Storm1 Resampling
3/4/2008	Pesticide Exceedance Report – Storm1 Monitoring
3/5/2008	E. coli/Metals/Physical Parameters Exceedance Report – Storm1 Monitoring
3/18/2008	Storm Sediment Sampling Event
3/19/2008	Field Exceedance Report – Storm Sediment Monitoring
4/2/2008	Toxicity Communication Report – Storm1 Monitoring
4/8/2008	Sediment Toxicity Exceedance Report – Storm Sediment Monitoring
4/9/2008	Storm Sediment Toxicity Resampling event
4/9/2008	Field Exceedance Report – Storm Sediment Toxicity Resampling
4/23/2008	Prop50 Chlorpyrifos Movement Evaluation (Round 1)
5/7/2008	Pesticides Communication Report – Storm1 Monitoring
5/8/2008	E. coli/Metals/Physical Parameters Communication Report – Storm1 Monitoring
6/1/2008	Prop50 Chlorpyrifos Movement Evaluation (Round 2)

Table 33. Table of SJCDWQC actions and deliverables dealing with exceedances and management practices relevant to the 2008 storm monitoring season.

County	Site(s)	Date	Category	Description	Who
San Joaquin	Lodi Area	1/16/2008	BMP Outreach and Education	California Cherry Research Review and Growing Sweet Cherries Organically- A Workshop. Research results comparing runoff volumes in a cover crop and clean cultivated conditions were presented.	Terry Pritchard
San Joaquin	Walnut Growers	2/28/2008	BMP Outreach and Education	Discussion of pesticide residues in runoff from walnut orchards. Blight, coddling moth and navel orangeworm control strategies were discussed with an emphasis on reducing irrigation runoff.	Terry Pritchard, John Meek
San Joaquin	Grant Line Canal	3/10/2008	BMP Outreach and Education	Meeting with landowners, pesticide control advisors and UC Ext personnel to discuss the storm water hits, 2007 hits, discuss alternative materials and practices.	Terry Pritchard
San Joaquin	Non specific	3/20/2008	BMP Outreach and Education	Air Quality and Water Quality Workshop (Stockton, CA). Discussion of water quality issues in the Coalition area during 2007 with examples of crop specific management practices.	Terry Prichard, Mike Wackman
San Joaquin	All sites in Stockton area	5/1/2008	BMP Outreach and Education	Grower outreach meeting discussing exceedances from the previous irrigation season and BMPs for the upcoming irrigation season.	MLJ-LLC, Mike Wackman, Terry Prichard

County	Site(s)	Date	Category	Description	Who
San Joaquin	All sites in Tracy area	5/2/2008	BMP Outreach and Education	Grower outreach meeting discussing exceedances from the previous irrigation season and BMPs for the upcoming irrigation season	MLJ-LLC, Mike Wackman, Terry Prichard

Exceedance, Communication, and Evaluation Reports

Exceedance and Communication Reports

Exceedance reports were submitted for all exceedances experienced during the 2008 storm season monitoring events. Communication Reports have also been submitted for all exceedances that occurred for the first time at a site. A copy of these reports is provided in Appendix V.

Evaluation Reports

Evaluation Reports were not required for exceedances experienced during the 2008 storm season events. Management Plans have superceded Evaluation Reports and will be submitted for each site subwatershed where two or more exceedances of a specific constituent were experienced during Coalition monitoring in September 2008. Management Plans will be reviewed and edited on a yearly basis to incorporate results from the previous years sampling and special studies. An updated Management Plan that will update sourcing, outreach and evaluation of water quality for each site subwatershed will be submitted on April 6, 2009.

Conclusions and Recommendations

Conclusions

Over the 2008 storm season, the Coalition was able to meet its monitoring program objectives:

- Determine the concentration and load of waste in discharges to surface waters.
  - The completeness of the analytical data was sufficient to determine concentration and load for all samples collected.
  - Quality control issues were present for a small number of samples, but the batches were evaluated using all LABQA results and were determined to be acceptable.
- Evaluate compliance with existing narrative and numeric water quality triggers to determine if implementation of additional management practices is necessary to improve and/or protect water quality.
  - The data for all constituents for which criteria exist were compared to the appropriate water quality trigger.
  - If samples existed in which the constituent exceeded the objective, it was determined that outreach would be performed and growers were encouraged to implement additional management practices.
  - A series of meetings with growers was held in which additional management practices were presented and growers were encouraged to implement the practices to protect water quality.
- Assess the impact of storm water discharges from irrigated agriculture to surface water.
  - Comparisons of monitoring data with water quality triggers allowed an evaluation of whether the water body was impacted by irrigated agriculture.
  - The level of impairment is difficult to determine solely from the data collected as ecosystem function is assumed to be impaired, but the mechanism of impairment is difficult to assess.
- Determine the degree of implementation of management practices to reduce discharge of specific wastes that impact water quality in receiving waters of the Coalition region.
  - The Coalition compiled responses from its BMP survey and is incorporating the results into the Management Plan to be submitted later in the summer.
- Determine the effectiveness of management practices and strategies to reduce discharges of wastes that impact water quality.
  - While the Coalition still does not have adequate data to evaluate the effectiveness of management practices implemented in the Coalition region, positive steps are being taken to obtain the necessary data. These steps include:
    - Obtain Coalition region-specific information on management practice effectiveness.
    - Create Coalition region-specific management practice handbooks for Coalition members.

        - Obtain information from growers in regards to implemented management practices and when they were implemented.
        - Create a database to track implemented management practices.
        - Link implemented management practices to changes in water quality as outlined in the Management Plan.
    - Proposition 50 grant money is being used to evaluate the effectiveness of a number of management practices in preventing degradation of water quality.
    - The Coalition obtained a grant from DPR to develop for growers a handbook of management practices for specific crops.
    - The Coalition initiated development of a member/parcel/crop relational database whose goal is to enable tracking of members by parcel, TRS, and crop on a real-time basis.
        - Classifying growers by location or crop will facilitate more immediate notification of exceedances and tracking of potential sources.
        - Knowledge of current crops grown by members allows the Coalition to provide growers with crop specific management practices.

To meet the Coalition's monitoring and reporting objectives, it is necessary for the monitoring data collected during the storm 2008 season to meet completeness objectives as outlined in the MRP.

- Only one of the two planned sample events was captured.
    - The winter was dry with only one storm meeting the trigger for collection; if the Coalition could have foreseen the dry winter, the trigger would have been altered to allow collection during a second storm.
- Chemical testing met the Regional Board's Reporting Limit requirements.
- Discharge measurements were collected from all sites at which it was possible to collect measurements.

The monitoring program provided the following technical conclusions:

- The most common exceedances were dissolved oxygen, *E. coli*, TDS/EC, cadmium, chlorpyrifos, diazinon, diuron, and toxicity.
    - Exceedances of diazinon will trigger management plans for the French Camp Slough @ Airport Way, Lone Tree Creek @ Jack Tone Rd, and the Sand Creek @ Highway 4 Bypass watersheds.
    - Other exceedances triggering management plans are diuron at French Camp Slough @ Airport Way and Roberts Island Drain @ Holt Rd, simazine at Unnamed Drain to Lone Tree Creek @ Jack Tone Rd, *Selenastrum* toxicity at Roberts Island Drain @ Holt Rd and Terminous Tract @ Highway 12, and *Ceriodaphnia* and *Hyalella* toxicity at Unnamed Drain to Lone Tree Creek @ Jack Tone Rd.
    - The *Pimephales* toxicity at Lone Tree Creek @ Jack Tone Rd has been attributed to dairy waste and although it is the second exceedance at the site, it will not trigger a

management plan. The previous exceedance was also attributed to a dairy discharge.

- The increase in cadmium exceedances is due to a reduction of the concentration of the WQTL.
  - Cadmium is a common detection in the region, including islands within the Delta, but the source of the cadmium is unknown.
  - Peat soils are known to contain cadmium at <1-3 ppm (http://www.speclab.com/elements/cadmium.htm). Peat soils, industrial emissions (i.e. burning of fossil fuels) and agriculture (i.e. phosphate base fertilizers) potentially contribute cadmium to aquatic systems.
    - Sources are distinguishable using stable isotopes but the cost of the analyses is substantial and the Coalition does not anticipate using this technique to identify the source(s).
- There have been an increased number of herbicide exceedances relative to previous years, particularly simazine and diuron.
  - A partial explanation is the large, non forecasted storm in January.
  - Herbicides have continued to be found at concentrations above the WQTL into the 2008 irrigation season suggesting that storm runoff is not the sole explanation for winter exceedances.
  - An increased number of *Selenastrum* toxicities support the conclusion that herbicides are impacting water quality.
- Sites with a majority of the exceedances to date continued during the storm 2008 season to experience exceedances for the same constituents.
  - Exceptions include Grant Line Canal @ Calpack Rd and Littlejohns Creek @ Jack Tone Rd which experienced no pesticide exceedances this season.
- In most of the site subwatersheds, sufficient data have been collected over the last several years to allow a more detailed analysis of pesticide use.
  - Multiple exceedances of pesticides at the same location over several years can be analyzed for commonalities in use patterns with exceedances.
  - Preliminary analysis for selected watersheds indicates that concentrations of chemicals in samples are correlated with the total pounds of active ingredient applied in the watershed.
    - These results suggest that the exceedances are the result of cumulative applications and not runoff from a subset of parcels.
  - Complete analyses will be presented in the Management Plan.

The winter of 2008 was very dry compared to 2007 which was in turn, drier than 2006. Only one storm was monitored in 2008, which was the only major runoff event after the dormant spray season. Compared to the first storm of 2007, there were more exceedances in 2008. The circumstances surrounding the first storm in 2008 were unusual. The storm occurred over a three-day holiday weekend and was not predicted. The fast moving storm system virtually materialized over Northern California within a 48 hour period bringing substantial amounts of rainfall to the SJCDWQC region. Many growers were finishing dormant sprays or applications of herbicides for weed control and were caught unaware by the storm. As a result, many applications were made immediately prior to the unpredicted storm event leading to conditions that maximized runoff.

Recommendations

The Coalition evaluates monitoring results and identifies opportunities for outreach. Outreach has increased over the storm 2008 season including six meetings with growers during the winter season. Meetings have been held at regional, group and individual levels to inform growers of current water quality problems and management practices that can be used to reduce/eliminate water quality impairments due to agriculture. Although these meetings would not have affected runoff during the winter storm season, contacts with individual growers appear to be a promising avenue for reducing runoff. The Coalition makes the following recommendations for its Monitoring and Reporting Program.

- Examine PUR reports from previous years to identify parcels that have been associated with repeated exceedances of pesticides.
- Associate exceedances of pesticides with crops known to use the products to further refine the search for sources.
- If applicable, follow the Management Plan monitoring plan by adding upstream sites to identify potential sources.
- Focus outreach on small groups of growers identified as potential sources.

The Coalition is in the process of developing a Management Plan that will identify agriculture sources, implemented management practices, and performance goals in response to water quality impairments. The Management Plan will be updated on a yearly basis to include monitoring results from the previous year and evaluate improvements in water quality due to outreach efforts and implemented management practices. The updates will also evaluate any new water quality impairments. The results from this SAMR will be included in the April 2008 Management Plan update and will review the recommendations provided above.

There are five main Coalition monitoring program plan objectives which are listed above in the conclusions. The Coalition Management Plan will supplement this monitoring report to meet the last three objectives:

- Assess the impact of waste discharges from irrigated agriculture to surface water.
  - For each site subwatershed within the Management Plan, all water quality data over all years of monitoring is reviewed to assess trends in and magnitude of exceedances.
- Determine the degree of implementation of management practices to reduce discharge of specific wastes that impact water quality in watersheds within the coalition region.
  - BMP surveys were conducted in 2007 and will be evaluated on a site subwatershed basis in the Management Plans.

    - The Coalition is developing a document to record management practices used by growers which will be filled out by a Coalition representative when contacting growers.
    - Information of management practices implemented by growers will be housed within the Coalition member database.
- Determine the effectiveness of management practices and strategies to reduce discharges of wastes that impact water quality.
    - The Coalition will first focus on high priority subwatersheds as described in the Management Plan to determine what management practices have been implemented.
    - The Coalition intends to link management practice information with water quality data obtained from monitoring as described in the MRP and Management Plan monitoring. The Management Plan will outline measures by which to evaluate improvements in water quality based on known management practices implemented within the area.

The Coalition is creating a strategy to document and evaluate current management practices within the Coalition area and will first focus on priority subwatersheds as outlined in the Management Plan. These include Duck Creek @ Hwy 4, Grant Line Canal @ Calpack Rd, Lone Tree Creek @ Jack Tone Rd and Unnamed Drain to Lone Tree Creek @ Jack Tone Rd. The Coalition is holding a site subwatershed and crop specific information meeting in July 2008 where members who are associated with exceedances in the Lone Tree Creek and Unnamed Drain subwatersheds (based on PUR data) will be invited to attend. It is the goal of the Coalition to link past water quality exceedances within these subwatersheds with crop types and inform growers of management practices that can be implemented specific to the crops in question. During this meeting, Coalition representatives will focus on talking with attendees and recording information in regards to current management practices being implemented. Although the Coalition conducted BMP surveys in 2007, the Coalition plans to supplement that information with more detailed information obtained from individual grower contacts starting with priority subwatersheds.

The Coalition received a Proposition 50 grant which has been used to target site subwatersheds with persistent exceedances of pesticides and toxicity. The most effective strategy, due to limited funding, was for the Coalition to focus on two watersheds which have experienced a large number of exceedances over multiple years. During the winter, studies to determine the efficacy of several management practices were initiated. Meetings with individual growers or small groups of growers were held to discuss exceedances originating on one or a few parcels. In the Grant Line Canal subwatershed, a large grower/operator changed products to help eliminate exceedances of chlorpyrifos. The same grower met with Coalition representatives to identify adjoining property owners in an attempt to contact other potential dischargers. One was identified but was found to be undergoing medical treatment for a serious illness and could not be reached. In the Lone Tree Creek subwatershed, Terry Prichard, a UC Cooperative Extension specialist, held meetings with small groups of growers to discuss exceedances and the water management practices that could be employed to eliminate discharge of pesticides. The results of these efforts will not be known until next winter.